

Vol. 5, No. 1

JUN 29 1917
UNIV. OF MICHIGAN
LIBRARY

JULY, 1917

THE SCIENTIFIC MONTHLY

EDITED BY J. McKEEN CATTELL

CONTENTS

EDUCATIONAL PREPAREDNESS FOR PEACE. Professor J. A. LEIGHTON . . .	5
RACE SUICIDE IN THE UNITED STATES. DR. WARREN S. THOMPSON . . .	22
COAL MINING IN CHINA. DR. ALFRED C. REED	36
THE HEALTHIEST OF MEN. DR. JAMES FREDERICK ROGERS	50
EUGENICS OF THE NEGRO RACE. Professor KELLY MILLER	57
THE PRINCIPLES OF HUMAN PROGRESS. Professor T. D. A. COCKERELL . . .	60
SOME OF THE NEWER CONCEPTIONS OF MILK IN ITS RELATION TO HEALTH. Professor LEO F. RETTGER	64
FOREST GROWTH ON ABANDONED AGRICULTURAL LAND. P. L. BUTTRICK	80
THE PROGRESS OF SCIENCE:	
Sir Henry Roscoe; Food Exhibition at the American Museum of Natural History;	
Scientific Items	92

THE SCIENCE PRESS

LANCASTER, PA.

GARRISON, N. Y.

NEW YORK: SUB-STATION 84

SINGLE NUMBER, 30 CENTS

YEARLY SUBSCRIPTION, \$3.00

A Remarkable Textbook

Barber's First Course in General Science

By FREDERICK D. BARBER, Professor of Physics in the Illinois State Normal University, MERTON L. FULLER, Lecturer on Meteorology in the Bradley Polytechnic Institute, JOHN L. PRICER, Professor of Biology in the Illinois State Normal University, and HOWARD W. ADAMS, Professor of Chemistry in the same. vii+588 pp. of text. 12mo. \$1.25.

A recent notable endorsement of this book occurred in Minneapolis. A Committee on General Science, representing each High School in the city, was asked to outline a course in Science for first year High School. After making the outline they considered the textbook situation. In this regard, the Committee reports as follows:

"We feel that, in Science, a book for first year High School use should be simple in language, should begin without presupposing too much knowledge on the part of the student, should have an abundance of good pictures and plenty of material to choose from.

Barber's *First Course in General Science* seems to us to best meet these requirements and in addition it suggests materials for home experiments requiring no unusual apparatus, and requires no scientific measurements during the course. We recommend its adoption."

Other Interesting Opinions on the Book Follow:

SCHOOL SCIENCE AND MATHEMATICS:—It is one of the very best books on general science that have ever been published. The biological as well as the physical side of the subject is treated with great fairness. There is more material in the text than can be well used in one year's work on the subject. This is, however, a good fault, as it gives the instructor a wide range of subjects. The book is written in a style which will at once command not only the attention of the teacher, but that of the pupil as well. It is interesting from cover to cover. Many new and ingenious features are presented. The drawings and halftones have been selected for the purpose of illustrating points in the text, as well as for the purpose of attracting the pupil and holding his attention. There are 375 of these illustrations. There is no end to the good things which might be said concerning this volume, and the advice of the writer to any school board about to adopt a text in general science is to become thoroughly familiar with this book before making a final decision.

WALTER BARR, Keokuk, Iowa:—Today when I showed Barber's Science to the manager and department heads of the Mississippi River Power Co., including probably the best engineers of America possible to assemble accidentally as a group, the exclamation around the table was: "If we only could have had a book like this when we were in school." Something similar in my own mind caused me to determine to give the book to my own son altho he is in only the eighth grade.

G. M. WILSON, Iowa State College:—I have not been particularly favorable to the general science idea, but I am satisfied now that this was due to the kind of texts which came to my attention and the way it happened to be handled in places where I had knowledge of its teaching. I am satisfied that Professor Barber, in this volume, has the work started on the right idea. It is meant to be useful, practical material closely connected with explanation of every day affairs. It seems to me an unusual contribution along this line. It will mean, of course, that others will follow, and that we may hope to have general science work put on such a practical basis that it will win a permanent place in the schools.

Henry Holt and Company

NEW YORK

BOSTON

CHICAGO

THE SCIENTIFIC MONTHLY

JULY, 1917

EDUCATIONAL PREPAREDNESS FOR PEACE

By Professor JOSEPH ALEXANDER LEIGHTON

THE OHIO STATE UNIVERSITY

THE word "preparedness," like other catchwords of the time, is frequently used without definition of the ends for which the country should prepare. This country is now, and somewhat belatedly, engaged in preparing to throw its full weight into the scales of battle in order to maintain and extend the principles of democratic and responsible government and to bring about a just peace in the only way now open to the world's free states, that is by beating to its knees as a suppliant German militaristic imperialism. The plans already set in train to achieve this end are fair and wise. Conscription, based on universal liability to service, is the only efficient, just and democratic means of raising a great army. Incomes should be conscripted by graduated taxation to meet the chief part of the costs of war.

But we, as a nation, should even now strive to take a longer view of things international. We should look beyond the war. The United States is in the strategic position where it can, if its citizens intelligently will, do more than any other state towards building on the results of this war the foundations of a new international order. The rudimentary beginnings of "A League of Nations to preserve Peace" already exist in the official conferences with our allies. Our cooperation involves much more than military and naval assistance. It involves international financial understandings, the international regulation of commercial shipping, of food production and distribution, of labor, of communications and news, and international scientific and technical cooperation. If we go about it in the right way, with an intelligent international mind and good will, our part in the war may be the most potent factor in bringing to an end exclusive, political and economic nationalism as a constantly disturbing factor in world-affairs. We may take the

lead in the establishment of a system of international organizations through which, in matters of banking and finance, trading, the migrations of labor, social legislation and administrative regulation of production and distribution, in fact, the internationalization of the chief material arteries and sinews of civilization, may be carried out far beyond the expectations of ante-bellum thinkers in the field of planetary politics. The internationalization of finance, commerce, the movement of labor, news-gathering, science and even art and letters was proceeding apace before the war broke out and largely without political organization. Does not the future peace and progress of humankind require the post-bellum acceleration of the process of internationalization by organization? Surely the cosmopolitan origins of our citizenry, our freedom from hereditary animosities and from the dead weight of outworn traditions, our quickness and openness of mind, our own rapid development in the socialization of democracy, and our active cooperation with all the foremost of the earth's progressive democracies, all conspire to mark out the United States as the nation which, having after long deliberation and without either racial animosity, traditional prejudice or the lust of exploitation, answered the battle call of freedom and justice, will give responsive ear and soul to the cries of the world-spirit of a humanity in travail and will take the leadership in bringing to birth the new international order built up around the Anglo-American principles of political freedom and responsibility and the French spirit of equality and comradeship. Is it not the duty of every American who can think, speak and write with a vision, however faint and vague, of a more rational future for humanity based on the principles and ideals which have nourished him, to do so without ceasing?

The supreme and ever urgent problem of world-politics is the mutual adjustment of nationalism, internationalism and democracy. And I think democracy has the key to this adjustment. The proposal to abolish nationalism is a vain and foolish dream. It can not be done and, if it could be done, the loss to mankind would be irreparable. For "humanity" without local habitation and name, without spiritual and political traditions and memories, without individuality of life, gifts, occupations and achievements, is a vicious abstraction, a barren phrase bathed in the mists of vacuous sentimentalism. The geographical, historical, cultural, and spiritual individuality of the nation is the familiar and nourishing soil on which the highest personal individuality develops and makes its specific contributions

to the life of the race. Only where the sense of social and spiritual solidarity has been strong in states and peoples have great and significant contributions been made to civilization. It was thus in the city-states of ancient Greece, especially Athens. It was thus in the Hebrew state and in republican Rome, in the renaissance city-states of Italy, in France, in England and in the German states. It is through the nurture and stimulation derived from interwoven group-individualities or spiritual wholes—the family, the school, the church, the craft, the community, the nation—that the human person grows to his full spiritual and intellectual stature, leads a full life and makes a worthy contribution to the race's material and spiritual wealth and welfare. Civilization does not grow in deserts, in dense forests, or in the eremite's cell. Not through the cult of the vague and formless abstract of "humanity" in general, but through life and action in the specific concrete and individual relations of definite social wholes, do rich and harmonious personalities, full-bodied happiness, and progressive cultures come into being and grow. The proposal to eliminate or ignore nationality, because of the evils of nationalism running riot, is on a par with the proposal to abolish the family and substitute free love and public nurseries, because of the failure of the institution of the family to attain universal perfection.

It is the nation seeking to live as an exclusive competing and dominating economic and political unit, the nation seeking territorial and commercial aggrandizement at the expense of other national units, the nation striving by foul means to get the best of the bargain, the nation puffed up with arrogance, fortified by ignorance and blindness to the worth of other nations that engenders in these days the evils of war.

The principle of democracy is the key to the situation. Democracy within the state means the equalization of opportunity for all members of the state, in order that they may be able to develop and exercise their several individualities, their native powers, in the way most effective to bring individual well-being and social welfare. The same principle must be applied to the relations of those more comprehensive individualities called "nations" and "peoples." Nations must have equal opportunities to develop and exercise their inherited and native powers (natural resources, political social and cultural traditions, the native qualities of their peoples); in short, their own specific individualities, with due regard to the like rights on the part of other peoples and to recognized standards of humane civilization and progress.

The democratization of international relations, which means their fuller moralization and humanization, will require that the nations which compose "The League to preserve a Just Peace" shall exhibit, running through their diverse cultural, geographical and economic individualities, a community of humanistic aims, interests and ideals, and that degree of similarity in political instruments and methods without which common aims and ideals can not be furthered. Only those nations in which the governmental agencies are completely responsible to the representatives, elected by vote of the whole people, for the conduct of international affairs, including the making of war and peace, will be qualified to cooperate in an International League of Peace. Only those nations in which small capitalistic groups seeking fields for exploitation, and munition makers, are powerless to influence international policies will be safe members of such a league.

An international league of peace will be nearly as powerless and ineffective in the face of a great international crisis as were the Hague Conferences, unless it has the backing of a powerful and intelligent public opinion. The development of an international and democratized public opinion, able to express itself effectively through the agencies of state in responsible governments is the only permanently effective way to reduce the chances of war. International organization, like national organization, should be the instrument of a common will; but the instrument will rust from disuse or be perverted by misuse, if there be not a common will in constant action. And a common will is nothing but a community of sentiment, thought and purpose among individual human beings and groups thereof. The sources of all volitions are blendings of instincts, emotions, ideas and images, from which arise new psychical complexes—sentiments or permanent tendencies to feel and act. The sources of public volitions are the interacting, conflicting and reinforcing sentiments of individuals. Public opinion is only the more definite articulation and forceful expression by speakers, writers, and leaders in action, of a community of dynamic sentiment in the masses. Where there is no congenital or nurtured community of sentiment there is no real public opinion, and action is then determined by the wills of small groups who hang together by community of sentiment and specific purpose playing upon the brute lusts and fears, gregariousness and pugnacity of the mass. Any oligarchy, whether it be a militaristic Junkerdom in Germany, a corrupt bureaucracy in Russia, a plutocratic group or just a gang of

political bosses in the United States, thrives and rules in essentially the same way—by sticking together and knowing just what it wants and how to get it in the absence of a community of vigorous sentiments and ideas on the part of the masses. In a final analysis political democracy means simply the conduct of the public activities of society that are necessary to the furtherance of the common weal through the resultant of the composition of forces operative in a genuine and general "public opinion." The possibility of a lively, healthy and intelligent public opinion is just the possibility of getting the average individual to think hard and to feel keenly in regard to public questions. This is clearly a problem of education. The individual who has not been stimulated and informed in the consideration of public questions before the age of twenty-one will probably always remain an inert lump in the body politic. (One of the shrewdest bits of jesuitical pedagogy that I have ever met was the new *Vereinsgesetz* proposed in Prussia while I was in Berlin, forbidding any person to take part in political associations before the age of twenty-one.) The permanence of democracy, and the possibility of permanent peace, depend on whether the average individual can be induced to think rationally and, hence, to feel justly and act intelligently on public questions. If he can not, democracy is a vain and foolish dream.

It is from this standpoint that I am about to discuss preparedness of national spirit. I recognize that, until there is radical alteration in the international world, better industrial, commercial and military preparedness are necessary for a nation-state that is determined to maintain its own integrity. Our defenses must be as strong as the strongest until there are cogent reasons for reducing them. Probably, until the new international order has been in successful operation for some time, we should have universal compulsory training for national defense as a permanent policy. Our future national policy on this matter should be guided by the political state of the world after the terms of peace shall have been signed. "Safety first" should be our motto.

Probably, universal compulsory training would better inculcate needed habits of obedience and discipline and markedly conduce to the development of a keener sense of national and civic obligation, a more general consciousness on the part of the citizenry of their indebtedness to the institutions which protect their lives, properties and families and secure to them the opportunities to enjoy the benefits of a humane civilization; though I confess to some doubts as to whether six months or

even eleven months military training would regenerate a slacker or give public spirit to a social parasite. It would probably do something for him and it would surely develop a stronger sense of national solidarity. The schools and the universal training have been the chief agencies in the psychical unification of Germany.

I am not ready to speak confidently of the social implications and consequences of the various schemes of universal and obligatory military training, when proposed as permanent policies. If the present war does not issue in the triumph of democracy, which is, I think, in principle non-imperialistic and anti-militaristic, if the war does not result in the establishment of "A League of Peaceful Nations," too powerful to be attacked by any combination of outsiders, then the United States must put and keep its whole man-power in a permanent state of training and organization for the defense of democracy. But I fear that universal military, and even industrial, preparedness as permanent war measures may prove blind and dangerous activities, inimical to national peace and world-peace, unless our entire citizenry are more effectively instructed in right conceptions of citizenship, so that they are able to form just and intelligent views in regard to national ends and international relationships. We must be careful that physical preparedness does not engender a bellicose and arrogant attitude towards other nations. We must beware lest military preparedness become a tempting weapon of aggressive nationalism, as it has proved in Germany. The crown of all our preparedness in other lines must be an intelligent moral or spiritual preparedness. Our citizenry must be trained to exercise an enlightened national patriotism as an element in world patriotism. We need a more efficient, humanitarian and farseeing educational preparedness.

Germany offers a striking example of what can be achieved, in the way of fashioning the thoughts, sentiments and purposes of a people, by a carefully planned and conscientiously executed system of nationalistic education and training, and an equally striking warning of the dangerous results in arrogant nationalism and overweening imperialism, which follow upon a one-sided emphasis placed upon exclusively nationalistic and imperialistic aims.

The Prussianization of Germany, and the organization of its total resources, achievements and trained energies to the ends of Germanic expansion and world domination, have been accomplished through a careful and elaborate system of social

organization and an equally thorough system of educational nurture. What we, in the United States, need to emulate is, not German arrogance and imperialism, but German efficiency in organization and training to achieve the ends which are aimed at. Our national ends should and will be different, and therefore the means will not be the same. But we can learn much from the Germans. The English can learn still more. German military efficiency has a deeper basis than the system of universal military service. Both the latter and the thorough social organization which feeds and supports it have their roots in, and draw their nourishment from, the German school system. The German educational system has developed a new imperial consciousness, a new national unity of thought and feeling, of purpose and will. The German schoolmaster has been the universal and efficient instrument of national preparedness. In him and the system which he has served so faithfully have the Entente powers met their most redoubtable foe.

The new German Empire, founded in 1871, was an aggregate of separate states, without community of sentiment and tradition, without community of political organization or ideas, without unity of thought and purpose. Between some of its chief constituent states there was much inherited mistrust, even ill will. The Bavarian and the Württemberger disliked the Prussian, while the Prussian had contempt for them. Sectional social, religious and political differences of long standing made the Empire seem but a loose aggregate, held together by a combination of pressure from without and Prussian energy and masterfulness within. In a trifle longer time than a generation there has been welded together, out of these heterogeneous and even hostile traditions and interests, one great people organized and directed by trained intelligence to achieve stupendous social, industrial and political ends.

Of the industrial and commercial progress made in this short period by Germany it is now superfluous to speak. Every intelligent person knows about it. Of the organization of the industrial, economic and social life for the furtherance of the common weal—of old-age pensions and accident insurance, of state-operated railroad, telegraph and telephone services, of well-planned and well-managed municipalities, of municipal gardens, theaters, music and art galleries—it is unnecessary to speak at length.

On the present direction of this highly organized, vigorous and intelligent national life towards an aggressive and ruthless policy of national expansion one need not comment. It is the

other side of the picture. A magnificent system of cultural and social organization has been prostituted to these ends, because the control of the whole system has been in the hands of a bureaucracy dominated by militaristic and imperialistic ideas and led by an arch-imperialistic autocrat.

It is a much easier task to direct a people bred to political docility, habituated in submission to direction from above, than it is to direct a democracy. Moreover, the rulers in bureaucratically governed countries have the great advantage of being able to get together and agree on the aims which they shall pursue, unhampered by the democratic babel. Both educational and social organization can be carried out more smoothly and efficiently in a nation of the German type than in a democracy. Thus the splendid development of German cultural organization has become the ready tool for a deliberate attempt at world-mastery. Though we may reprobate some of the ends sought and the means employed, Germany's example is none the less thought-compelling.

A new world-situation will ensue upon the cessation of this war, and, if Western civilization is not to expire, strangled in the Nessus shirt of its conflicting nationalistic imperialisms, a new world-organization must be built up. In that new world an American may believe and should resolve that democracy will occupy the place of leadership. If we Americans respond to the duty laid upon us by the insistent hour, world leadership should, in large measure, fall to the United States. We owe it to the world's future, as well as to our own future, to prepare to execute our stewardship.

The impending future of the world calls in clamant and urgent tones for a new international political system. The time is now near at hand for the liberally-minded nations to organize for the maintenance of permanent peace, by the formation of some sort of international agreement, and the establishment of some sort of tribunal with power to settle international disputes and to make war both difficult and dangerous to enter upon. The organization must be based upon the democratic principles of equality and justice among nations. It can come into being and continue in being only if democratic principles prevail more and more effectively in national governments all over the earth. These principles will prevail only if the leading democratic states develop greater clearness of conception, firmness of conviction, and effective cooperation with respect to the rules of conduct for states as members of the international order. The very foundations of an international

order are yet to be laid. Dynasts, militarists, capitalists and diplomats can not be trusted to lay these foundations. They must be laid in the moral and social intelligence and feeling of the earth's peoples. The extension of democracy and the cultivation of its political intelligence are the only sure roads to lasting peace. The development of sympathy depends upon the development of understanding. To understand is to sympathize. Therefore international sympathy and forbearance, international justice and equity, are predicated upon international understanding; and only through the growth of intelligent democracy is increase of international understanding possible. The will of man is not a separate psychological entity that operates on its own hook. A man's will consists of his interests, organized and directed by intelligence. So with a nation's will. International good will will follow upon an intelligent recognition of community and interdependence of interests among the *peoples*. This community and this interdependence of interests does not exist among dynastic autocrats, oligarchic governing castes, militarists, money-lenders, and the diplomatic tools of these interlocking directorates of nations. But community and interdependence of interests does exist among all the peoples of this earth, if they can only be brought to see it by the training of their political and social intelligences. When they do see it they will cease to be led by the nose to slaughter at the behests of their rulers.

The fundamental and essential condition for the maintenance and spread of peace, based on a fair and humane international order, is the effective operation of an intelligent and therefore a just humane and peaceful public opinion within the several nations—a public opinion which shall exercise control over the nation's policies in both national and international concerns. The time has arrived when the voter, who may have to do the fighting, must learn to think clearly and act vigorously in terms of the nation's moral relations to other nations, in terms of the nation's duties and responsibilities, no less than of its rights and privileges, in the comity of nations.

The United States is a great world-state. It must prepare to function more intelligently and vigorously as a leader among states. It must assume its part in the pains and efforts of the world to bring to birth and fruition a new moral world-order. The American must acquire the habit of thinking in international terms. He must learn to consider his domestic social and political problems, the organization of industry and commerce, the production and distribution of wealth, protection

and free trade, the development of science and education, in the light of world organization; in the light of the same problems as they exist for other states. The days of our isolation have been long past, but many of us did not awaken to cognizance of the fact until the world-war rudely disturbed our parochial habits of mind and action and we found, to our irritation and perplexity, that we are our brother's keepers and that we can not stand apart from the dominating world-currents and remain a great state. In the past three years of our national life there have been many happenings on our own soil as well as on the high seas that will cause our heirs to look back with feelings other than unmingled satisfaction upon the recent past. It can not be said that we have acquitted ourselves with unqualified distinction as protagonists of international justice and humanity, defenders of the rights of non-combatants and neutrals and defenders of our own national rights. And the causes are only in part the presence on our soil of so many children and grandchildren of the warring nations who have striven to import into the determination of our policies, in delicate and complicated international situations, the national sympathies and antipathies of their European origins. The causes are also in part the unintelligent isolation and ignorant disregard of international affairs in which our people have been nurtured and have lived. We have been so engrossed with the material and cultural development of our native resources, with building up an industrial democracy on a virgin continent, that we have neglected international questions. We have some good excuses. Owing to our geographical isolation and our economic self-sufficiency, we have not been frequently threatened by international conflicts. We set out upon our national career with a happy unity of language and institutions, and we fortunately discovered the great principle of federation and successfully maintained it in the civil war. The great variety of languages, traditions and institutions, which lend such picturesque charm to Europe in days of peace, are the unhappy sources of conflict which force the intelligent European to be more internationally minded.

Our geographical isolation has been annihilated by rapid transit and well-nigh instantaneous communication. The exploits of German submarines off our coast have demonstrated that we can not any longer hide behind the seas in time of war. For the purposes of both peace and war the world is fast becoming unified. Our social task at home is now, not so much the exploitation of nature as it is the elimination of the ex-

exploitations of man by man, the social control of economic production and distribution for the development of a more equitable and richer type of commonweal. Thus in the economic problems and conditions of our domestic life, we are rapidly approaching the status of Europe before the war. After the war the same problems of social organization for equalization of opportunity will confront America and Europe; with this difference, that our economic power will be greater than Europe's, and therefore it will be harder for us to practise saving and efficient cooperation. We shall not suffer so acutely from the war as Europe is suffering. Europe will become both more democratically socialized and more efficiently organized. The methods of national organization, necessitated by the war, will not be scrapped. Before the war Germany was the most highly socialized country in Europe; but the authority and initiative in this process resided in an oligocratic bureaucracy. The results of the war will, in all probability, discredit and weaken the Prussianized oligarchy, as it is already doing in Russia. Germany and Russia will, I think, inevitably become much more democratic. England, France and Italy, which were rapidly developing in the direction of socialized democracy before the war, will probably continue to do so at an accelerated pace. Our economic and industrial life must undergo a corresponding socialization if our nation is to continue in the lead. This socialization must not be a mere war-measure. It must be permanent. Since social and political intelligence, impelled by moral sentiment "in widest commonalty spread," is the only hope for an efficient, honest and progressive democracy, the task of education is of paramount importance. In a democracy of our type the keys to the progressive or evolutionary solution of national and international social problems must be forged in the homes, the schools and the colleges.

The supreme task of the school in a democracy is education for the intelligent practise of citizenship in the nation and in the world. Such problems as vocational training, or the respective values of science and language study are secondary in importance. The schools must prepare the embryo citizens to be good citizens, not simply to make a living. If they be given sound elementary instruction in their mother tongue, in elementary mathematics and science with especial reference to its applications, and if their bodies and characters are developed in a physically and morally sound environment in the home, school and community, there will be no trouble in regard to their making a living. (The ensuring of the sound environment of

course involves considerable social readjustment.) The schools must prepare the coming citizens to be good citizens of the nation and the world. And I do not see how this can be done without systematic instruction in the elements of social and political ethics. As matters stand now many a good workman or business man is a poor citizen, when it comes to the exercise of his public duties.

The American public has of late been told repeatedly, and by some persons who should know better, that Germany's success in the war has been due to her assiduous cultivation of science and her neglect of the humanities, and that England's slowness and early failure were due to her neglect of science; whereas England's ability to get widespread sympathy for her case in neutral countries has been due to her emphasis on the humanities in education. The explanation is too simple and is not in accord with the facts. England had been a citizen of the world these many centuries, whereas Germany is a new-comer. The British Empire is a world-encircling cluster of democracies. England has had long practise in international dealings. The English are men of the world to a much greater extent than the Germans. Moreover, democracies, especially if they be of the same speech, will instinctively sympathize with a democracy, North Americans with the English (and for historic reasons with the French), South Americans with the Latins.

Germany's success has been due, aside from her long and arduous military and naval preparations for war, to her power of intelligent organization and her highly developed national consciousness. This organization is the result chiefly of two factors—a splendid and long-established system of universal public education and a greater socialization of the instruments of social well-being. England's failures (and, of course, to a vastly greater extent, Russia's failures) have been due to the comparative neglect, until recently, to establish a universal system of free public education, and to the economic individualism which has failed to furnish decent means of sustenance for much of her population.

The lessons of this conflict, up to date, are not that science has superior fighting value to the humanities in education. Germany has maintained the study of the humanities, without neglecting to develop education in science. In all probability (I have not the figures) a larger proportion of German boys than of English boys study Latin, modern languages, and history. The lesson of the conflict is the tremendous national

power and efficiency that is engendered by a universal system of public education, organized and conducted as part of a coherent scheme of social organization; in contrast with a more or less hap-hazard and go-as-you-please national activity in education and industry. The issue is between the national organization and control of education to national ends, by the development of the best technique made accessible to all, and the leaving of educational control and enterprise at the mercy of local politics, sectarian religious prejudices, parochial parsimony and unintelligence. Germany is reading the world an effective lesson in the value of the control of education by the state and the enforcement of high standards of educational efficiency, as the condition of national efficiency. At the same time the example of Germany warns us that national education should be directed towards international welfare in place of a chauvinistic national expansion. The nation will fail in the future and will lay up trouble for itself and the world, if it does not make training in social and international ethics, the education of its citizens to be intelligent members of the world's democracy of states, an integral part of its universal and public scheme of education. The coming citizens should be trained as if a world federation were coming into being through their efforts. Only in this way will an effective international organization for peace with justice ever really come into being. I venture to make some suggestions as to how this end may be set about.

What is most urgently needed in public school education is not so much a concordat between the conflicting claims of the natural sciences and the humanities, as it is science, literature and history all taught in a more liberal, more inspirational and humanistic spirit, as expressions and instruments in humanity's universal struggle towards liberation and self-fulfilment. The primary aim of public education in the schools should be, not the development of technical skill in the handling of physical processes (that will come later for those who need it) nor the development of dialectical subtlety through grammar nor the stimulation of the ability to solve puzzles through tricky mathematics; it should be humanistic inspiration and ethical and social enlightenment through the study of literature and history, and of science treated as a humanistic instrument of social progress, followed by the study of social and international ethics, which are the keys to politics and civics. Literature and history, including the story of the growth of the scientific spirit, taught as records of the progressive moralization of the

human soul, as instruments of ethical and intellectual inspiration and enlightenment, as the progressive expression and record of the human spirit in its struggles towards more intelligent and harmonious individual self-development and social integration, should be the basis of all our education. Thus the average citizen should develop a more vivid and intelligent sense of the moral foundations of international relationships, as well as of intranational social relationships, and a stronger and more enlightened conviction in regard to the moral and rational forces operative in history. For history can best be taught as the working out, on large-scale patterns in space and time, of a moral and rational world-order, of the progressing refinement and increasing recognition of ethical values, and of the steady elevation of the human race through the more effective realization of just and humane purposes, through the operation of social intelligence. So to teach history that the working of a moral and rational order is discerned therein is not to distort the facts. It is rather to select, organize and interpret the facts that are worthy of perpetuation and study. It is the only method of dealing with historical study that justifies the labor and time spent upon it, by finding in it meaning and worth for living humanity. Otherwise history becomes the disconnected, muddled and dispiriting tale of an endless, purposeless sequence of events, conducing only to mental ennui and moral pessimism in its students.

Literature, science and history should be taught in a more humanitarian, cultural and cosmopolitan spirit. We have, in our own tongue, a literature including the English Bible that is unrivalled perhaps, certainly not surpassed, by any other in its wealth of concrete instructional and inspirational material for the nurture of the moral spirit, a great thesaurus of moral and spiritual example compacted of the creative imagination. What is lacking in teaching literature is the selection and arrangement of this rich material in an order corresponding to the stages in the psychological development of childhood and youth. There is also a dearth of teachers qualified, by experience, training and personal power, to open up the treasures of literature and history, and to draw out their ethical applications to the individual life, and, more especially, to the moral issues of the social and international orders.

In the final analysis every social problem and every political issue, whether in the municipality, the state, the nation, or international affairs, is an ethical problem—a problem in human conduct, to be solved by the exercise of an intelligent good will.

Every conflict in these social fields is between a lesser good and a greater good, between a best and a good which, by opposing the best, becomes the bad in that particular connection; between individual interest and the welfare of a group, between class interest and a wider common weal, or between a chauvinistic nationalism and a just and humane internationalism. It is quite as important that the ordinary citizen should be equipped with the tools and the materials for intelligent reflection and action in regard to matters of international conduct and misconduct as that he should be equipped to think intelligently and fairly in regard to the principles and facts of conduct between fellow-citizens or business associates or neighbors or members of his own family. "Social justice" can not be realized apart from international justice, nor international justice apart from social justice within the nation. As the world becomes more and more unified, economically, industrially and by interchange of methods of organization and thinking, it will become more and more impossible to settle large issues of national policy without regard to the international issues involved therein. Behind every issue now in regard to international rights and obligations, political sovereignty, trade arrangements, national autonomy and national expansion, there is a moral issue which is usually obscured by a tangle of legal and diplomatic verbiage or hidden by the devious ways of international finance or by the fuming vapors of a narrow and exclusive nationalism. The German invasion of Belgium, for example, involved a plain moral issue which the German government and its professorial henchmen have sought to cover up, but have egregiously failed to do.

If law and administration within the nation must be controlled by moral principles, it is equally true that trade arrangements and all diplomatic and treaty relations between nations must be similarly controlled, as indeed the laws on international copyright, extradition, protection of the persons of nationals, navigation and postal matters are now controlled. There can not be one standard of equitable dealing between citizens of the same state and an entirely different standard, or no standard at all, between states. The present war exemplifies, upon a more stupendous scale than any previous international conflict, the enormous folly and cost of educating the citizens of a state in their duties towards one another, as members one of another, and at the same time denying or ignoring the existence of any parallel international obligations or common membership and participation in the life of humanity. The war is a tragically

stupid catastrophe, precipitated primarily because German intelligence ceased to operate beyond the German boundary.

We could dispense in our schools with a good deal of the abstruse mathematics and grammatical technique now taught. But, at our peril and at peril to humankind, we dispense with the moral stimulation and enlightenment of literature and with the instruction and warnings of social and political history, when these are effectively taught. We can no longer afford to neglect the teaching of social ethics and civics in the setting of world-civics and world-politics. If national and international politics are not to be devil's games, they must become fields for the application of the common man's instructed moral insight. A democratic state can not safely leave instruction in civic ethics to the homes and the churches.

Furthermore, if we are to get an efficient training of our coming citizenry in the ethics of civic and social relationships viewed as a part of the totality of humane world-relationships, we must have a national control of education to national and international ends. Our state-systems of education are not sufficiently centralized. There is too little control over the standards of teaching and the contents of the curricula. The appointment of teachers is too much subject to local politics and local parsimony. The states should control standards and curricula more effectively. They should have a check upon salaries and appointments. But, in this matter, the cure might be worse than the disease if state superintendencies and boards are not entirely removed from the vicissitudes of state politics.

The nation, through its department of education, should control the standards of teaching and the minimal contents of the curricula. We have heard much lately in regard to the "New Nationalism" and the "New Americanism," but little as to what these catchwords mean. I would have the new nationalism and the new Americanism include, as paramount features, intellectual and moral preparedness for the maintenance of a peace founded upon international justice, through effective national control of the educational instruments for training in the principles of citizenship and world citizenship.

We shall never secure a high educational efficiency in this country until the states compel a higher economic and scholastic minimum for the teacher—until by state action the economic, professional and social status of the teacher is considerably improved, and thus abler and more vigorous personalities are induced to make teaching their vocation. And we can not be sure that this purpose will be speedily consummated, unless the

national government has the power to enforce it on the several states. Local autonomy unregulated too often becomes chaos and sometimes remains chaos.

We shall never ensure that the coming citizenry is decently instructed in the elementary moral principles of citizenship and receives adequate enlightenment upon the ethics of social, national and international relationships, until the national department of education has power and authority to prescribe a minimal program of instruction in civics and social and international ethics, based upon a more broadly and humanistically conceived program in history and literature—in short *the nation* must effectively require that in every nook and corner of this broad land the boy and the girl are brought to exercise their intelligences upon, and apply their consciences to, the fundamental issues of social and political ethics in their national and international bearings, no less than upon matters of private personal relationships. Can anything be more important in a nation in which public opinion makes policies, or should make them, and in which if public opinion does not shape policies they are shaped by ringsters and grafters or by cliques and third-rate pothouse politicians? In an autocracy the people are relieved of moral responsibilities for public policies by the imperial keeper of their consciences. "Theirs not to ask the reason why, Theirs but to do or die." In a democracy there is no keeper of the public conscience. If the people do not jointly and severally keep their own political consciences there is none. And conscience is not kept by lack of training and exercise. It dies if it is not used. Is there any subject of more paramount and urgent concern to a democracy than instruction, training and reflection in public ethics. If it is worth while for the state to educate future mechanics and tradesmen, farmers and professionals, surely it is ten times more worth while to educate future citizens to be *citizens*. Nay more, it is suicidal for the public agencies to take care of all the specialized educational interests and neglect the basic general interest in a nation that, by hypothesis, is made up, not of mechanical puppets pulled by autocratic strings, but of intelligent freemen able to conduct their own affairs.

RACE SUICIDE IN THE UNITED STATES

By Dr. WARREN S. THOMPSON

UNIVERSITY OF MICHIGAN

THERE are many people who think that race suicide means there is little or no natural increase (annual excess of births over deaths) in our population. Well-informed students of our population questions, however, have never used the term in this sense. They have never feared that our population was not growing rapidly enough by natural increase to hold its own with that of other countries. Professor Ross originally used the term—race suicide—to characterize what he believed to be a movement in the growth of our population leading to the extinction of the older native stock and its replacement with the newer immigrant stocks—the Slavic, the Latin and the Hebrew. According to this view our vital population questions are not questions of mere numbers but rather questions of quality.

Are the people of the older stock—those of Anglo-Saxon and Teutonic descent—gradually dying out and are they being replaced by the immigrants from southern and eastern Europe? If this is the case what are the effects upon our civilization going to be? These are the questions of vital concern to Americans. Those who believe that the older stock is dying out are quite likely to believe that with it are going the ideals and aspirations which have made America distinctive among the nations of the world. They feel that these new peoples with different racial traits, with different national histories and with different cultures are certain to make an America, not only different from but inferior to, what it would be if left in the possession of the older stock.

THE EVIDENCE OF RACE SUICIDE

Most of the evidence of race suicide comes from investigations made in New England. In Boston it was found that the old American stock has a natural increase of only about one per thousand per annum. As the report points out this is probably too low a rate of increase to represent the condition of the old native stock in other parts of the state but yet it shows that this stock is increasing very slowly. The rate of natural increase for the whole state is about ten per thousand per annum.

There is no room for doubt, therefore, that the newer stock is rapidly becoming a larger proportion of the entire population.

Another investigation giving much the same results was made by the Immigration Commission. It was found that in Rhode Island the native white women of native parentage who had been married from ten to twenty years had borne an average of 2.5 children, while the white women of foreign parentage had borne an average of 4.5 children. Thus the women of newer immigrant stock bore almost twice as many children as the women of native stock.

Experience and observation also confirm the more exact investigations. Those familiar with conditions in New England have borne almost universal testimony to the effect that the families of the older native people are smaller than those of the newer immigrant peoples.

There seems to be but one conclusion that has been drawn from such facts, viz., that the newer immigrants and their descendants are steadily becoming a larger proportion of the whole population. Without waiting to see whether other investigations in other parts of the nation would give similar results most people who have discussed this question have assumed that there is a general movement of this nature in our population. The result is that there has been a great hue and cry raised against race suicide. Before we join in this outcry, however, and indiscriminately urge people to raise larger families as some have already done, we should examine the facts more carefully.

There is very good reason to believe that the movement of population in New England is not typical of all parts of the United States. In the first place, New England has a larger urban and industrial population than any other section of the country. If, therefore, there is any difference in the rates of natural increase in the urban and rural populations they would not show in their true proportions in a study of the movement of population in New England. Besides most of the investigations and observations already referred to have been made in the cities. In the second place, the very fact that New England has a very large proportion of immigrants may have a direct effect upon the rate of natural increase of the native population. General Walker pointed out long ago that immigration was, in part, at least, a substitution of incoming peoples for those who would have been born to native parents had the immigrants not come. In the third place, the number of children born to native and foreign mothers is not a good measure of

THE PROPORTION OF CHILDREN TO WOMEN IN THE URBAN AND RURAL
COMMUNITIES OF THE UNITED STATES, ALSO IN CERTAIN SELECTED
CITIES AND FOREIGN COUNTRIES

Geographic Area	No. Children Under 5 Yrs. per 1,000 Women 15-44 Yrs.	No. Children 5-9 Yrs. per 1,000 Women 15-44 Yrs.	Per Cent. of Total Popula- tion Comprised by Women 15-44	Per Cent. of Total Popula- tion Native Born of Native Parents
United States:				
Urban, white	382	341	25.4	41.9
Rural, white	603	555	21.2	64.1
Urban, negro*	290	298	31.0	6.3
Rural, negro*	652	641	22.5	14.5
New England States:				
Urban, white	384	345	25.7	33.9
Rural, white	458	437	20.4	69.8
Middle Atlantic States:				
Urban, white	402	351	26.2	34.4
Rural, white	518	477	21.2	67.0
East North Central States:				
Urban, white	382	340	25.9	41.7
Rural, white	523	506	21.3	66.5
West North Central States:				
Urban, white	344	317	26.4	51.2
Rural, white	582	548	21.3	58.5
South Atlantic States:				
Urban, white	393	354	26.4	54.2
Rural, white	678	604	21.5	62.2
Urban, negro	296	298	31.1	29.4
Rural, negro	689	666	22.1	35.2
East South Central States:				
Urban, white	378	349	26.7	54.4
Rural, white	696	619	21.6	67.2
Urban, negro	272	281	31.1	32.3
Rural, negro	620	609	22.9	31.4
West South Central States:				
Urban, white	405	384	26.0	58.4
Rural, white	729	658	21.2	67.7
Urban, negro	298	317	30.6	22.3
Rural, negro	621	636	22.7	22.7
Mountain States:				
Urban, white	382	350	25.5	51.9
Rural, white	641	564	19.9	57.8
Pacific States:				
Urban, white	301	271	25.7	46.9
Rural, white	509	480	19.9	54.8
Boston, white	354	316	27.1	23.5
Fall River, white	445	397	26.4	13.3
New York City, white	394	341	27.2	19.3
Pittsburgh, white	420	354	26.0	33.0
Chicago, white	390	333	26.5	20.4
Cincinnati, white	294	266	27.7	42.6
Cleveland, white	433	349	25.9	23.6
Indianapolis, white	292	282	27.7	64.5
Milwaukee, white	388	345	26.1	21.1
Kansas City, Mo., white	270	248	28.6	61.9
Minneapolis, white	312	267	27.6	31.9
St. Louis, white	325	294	27.5	39.3
Baltimore, white	360	343	26.6	46.8

* This includes only the negro population of the South Atlantic, the East South Central and the West South Central States.

Geographic Area	No. Children Under 5 Yrs. per 1,000 Women 15-44 Yrs.	No. Children 5-9 Yrs. per 1,000 Women 15-44 Yrs.	Per Cent. of Total Popula- tion Comprised by Women 15-44	Per Cent. of Total Popula- tion Native Born of Native Parents
Birmingham, white.....	459	398	26.0	50.0
New Orleans, white.....	371	367	26.4	43.5
Salt Lake City, white.....	442	372	25.7	41.1
San Francisco, white.....	278	238	25.6	27.7
Seattle, white.....	286	256	25.6	44.6
United States, 1910 (white only) ..	484	440	23.3	
Australia, 1911.....	499	431	23.6	
German Empire, 1910	535	499	22.8	
France, 1901.....	409	367	22.8	
England and Wales, 1901.....	458	429	25.0	
1911	429	411	25.0	
Sweden, 1910	522	490	21.5	
Italy, 1911.....	566	492	22.0	
Russia (European), 1897.....	675	543	22.4	

the respective rates of natural increase. The death rate of the children of immigrants is much higher than that of children of natives. The presumption, then, is decidedly against accepting the view that the movement of population in New England is typical of all parts of the United States.

THE MOVEMENT OF THE POPULATION IN THE DIFFERENT SECTIONS OF THE UNITED STATES

In order to show the relative rates of increase of the urban and rural populations in different parts of the country I have prepared the table on p. 24. In this table the number of children 0-4 and 5-9 years of age (columns 1 and 2) per 1,000 women of child-bearing age—15-44 years of age—is given for a number of the different geographical and political units of the nation. The proportion of women 15-44 years of age and the proportion of native population to the whole population (columns 3 and 4) are also given for each of these units. At the end of the table will be found some of the same data for a few foreign countries.

Although this is not the most accurate way possible of measuring the rate of natural increase in different classes of the population and in different sections of the country, it is the best at present available and, on the whole, gives us a very good notion of the movements now taking place. The proportion of children to married, widowed and divorced women would not be as good an index of natural increase, because the presence of a large number of unmarried women or women who marry late in life, as in our city population at present, is in itself a proof of race suicide. To eliminate these women from the cal-

culations would, therefore, be to secure a measure of the relative size of the family in the country and the city rather than a measure of the natural increase.

The following data will show, however, that the conclusions to be drawn from the table referred to above would be corroborated by a more detailed study showing the proportion of children to married women.

NUMBER OF CHILDREN UNDER 5 YEARS OF AGE PER 1,000 MARRIED, WIDOWED, OR DIVORCED WOMEN 15-44 YEARS OF AGE IN THE URBAN AND RURAL COMMUNITIES OF THE UNITED STATES AND ITS GEOGRAPHIC DIVISIONS (WHITE POPULATION ONLY)

	Urban	Rural
United States	660	933
New England	714	718
Middle Atlantic	709	827
East North Central	645	828
West North Central	599	937
South Atlantic	672	1066
East South Central	632	1047
West South Central	633	1050
Mountain	601	907
Pacific	489	754

The fact standing out most clearly in the table given above is that in every state the proportion of children to women is greater in the country than in the cities. In the New England States as a whole the number of children under five years of age to 1,000 women is 19.3 per cent. greater in the rural districts than in the urban. In all the other geographical divisions of the nation the difference is even greater than in New England. In the Middle Atlantic States it is 28.8 per cent., in the East North Central States it is 36.9 per cent., while in the West South Central States it is 80.0 per cent. These facts show beyond question that the rural population has a greater rate of natural increase than the city population.

The full significance of this fact only becomes apparent, however, when we compare the proportion of native population in these two classes of communities. The proportion of native stock is invariably greater in the country than in the city. The greatest differences are to be found in New England and the Middle Atlantic States, but the difference is also considerable in the East North Central States. In the other parts of the nation the differences are not very large. It is also worth noting that in those sections where the differences are greatest the foreign stock in the cities is of the newer immigration,

while in those sections where the differences are comparatively small the foreigners in both country and city are of the older immigration.

THE INCREASE OF NATIVE AND FOREIGN STOCK IN THE CITIES.

The proportion of children to women in the urban population shows a remarkable uniformity throughout the United States. Only in the West North Central and Pacific States does the proportion fall below 375 per 1,000 and it exceeds 425 in only a few of the states—chiefly the southern states. But in spite of this great uniformity, it is apparent that those urban communities of the north and west of which the newer immigrants form a large proportion have a greater number of children per 1,000 women than those in which the proportion of native stock, or older immigrant stock, is large.

This appears more clearly if instead of confining our attention to the geographical divisions we pick out certain cities representative of different elements of the population. Practically any of the larger cities in the northeastern part of the country have a large proportion of the newer immigrants. Boston, New York, Chicago, Cleveland and Detroit, as well as many others, have a proportion of children much greater than Indianapolis, Kansas City, Denver and Los Angeles. In the former, people of the newer immigrant stocks predominate, while in the latter native stock predominates. In such cities as Cincinnati, St. Louis, Milwaukee and Minneapolis, where the older immigrant stocks (chiefly German and Scandinavian) predominate and there is also a good proportion of native stock the proportion of children is smaller than in the cities with the newer immigrant stocks, but larger than in the cities where native stock predominates. In the distinctly southern cities, however, where the white population is almost entirely native stock, the proportion of children is little, if any, smaller than in the northern cities with a large proportion of the newer immigrant stock. But only a small proportion of the city population of the United States is to be found in the southern states.

If, then, it were a question of the relative rates of natural increase of the native and immigrant stocks in our urban population only, there can be no doubt that the newer immigrants would become a steadily increasing proportion of the whole, with the older immigrants a poor second and the native stock an "also ran." But the urban population was only about 46 per cent. of our entire population at the last census. Therefore, before we become unduly excited about the extinction of the

Anglo-Saxon and Teutonic stock in our country, let us examine the data showing the proportion of children to women in the rural districts rather carefully.

THE INCREASE OF THE RURAL POPULATION COMPARED WITH THAT
OF THE URBAN POPULATION

Although, as was pointed out above, the proportion of children in the rural districts is everywhere greater than in the cities, there is by no means as great a uniformity in this proportion in the country as in the city. There are three general divisions into which the states fall with respect to the proportion of children to women in the rural population:

1. *The New England and the Atlantic Coast States as Far South as Delaware.*—In these states the number of children varies from 412 in Massachusetts to 493 in Maine. This is the smallest proportion for any group of states. In all these states the rural population is a relatively small proportion of the whole and is largely composed of the old native stock. There has been a selective process going on for several generations in the rural population of these states. The more active, wide-awake, and ambitious men and women have either gone west to new lands or they have migrated to the cities to seek their fortunes. This has had a detrimental effect upon country life and is probably responsible in large measure both for the decadent population now to be found in the rural districts of these states and the unprogressive character of the farming carried on there.

2. *The States of the Northern, Central and Western Part of the Country.*—In these states there is a wide variation in the proportion of children to women. In general, however, they have more than 500 and less than 600. California and Nevada have less than 500, while the Dakotas and some of the other northwestern states have over 600. There does not seem to be any close relation between the foreign stock and a large proportion of children to women in these states. It is true that North Dakota with a very large foreign element in the rural population has over 700 children per 1,000 women, but there are several states with a preponderantly native element in the population which have a larger number of children per 1,000 women than Minnesota and Wisconsin, in which the population is largely composed of Germans and Scandinavians and their children. In those states where frontier conditions still exist, we almost invariably find a relatively large proportion of children. Thus the proportion of children in the rural population

seems to depend on the opportunities open to children in the country rather than on whether the people are old native stock or the older immigrant stock. The relatively small proportion of children in some of the far western states which still have frontier conditions is probably due largely to the greater independence and self-assertion of the western woman.

3. *The Southern and Southwestern States.*—In these states the number of children rarely falls below 650 per 1,000 women and in many exceeds 700 (we are discussing the white population only). In all these states the rural population is almost entirely composed of the old native stock. In the West South Central States about 10 per cent. of the population is of foreign stock. In the South Atlantic States only about 2.5 per cent. of it is of foreign stock, while in the East South Central States the proportion is even smaller. We are, therefore, justified in speaking of the rural population of this third great division as a native population, and it is in this part of our population that the greatest natural increase is taking place. As in the western states, where pioneer conditions still exist, the opportunities for children to do as well as their parents are relatively good here, and this is one of the important reasons for the high proportion of children.

Of our entire white population 51.3 per cent. lives in the rural districts, the remainder in the cities. In 36.6 per cent. of the rural population there are 650 or more children per 1,000 women; in 52.5 per cent. of it there are 500 to 650 children per 1,000 women, while in only 10.9 per cent. does the number of children fall below 500 per 1,000 women. In only 25.0 per cent. of the urban population, on the other hand, does the number of children rise above 400 per 1,000 women. Of this 25.0 per cent. over one fourth lives in the southern states, where the white population of the cities is almost entirely native stock. The other three fourths live in Connecticut, Pennsylvania and New Jersey, in none of which the number of children exceeds 433 per 1,000 women. Of our total white population in which the number of children exceeds 400 per 1,000 women, six sevenths live in the rural districts and one seventh in the urban.

The number of Italians, Slavs and Jews—the newer immigrants—to be found in the rural districts of the great agricultural states is negligible. On the other hand, the number of Germans, Scandinavians, English and Irish and their children is large, approximately one fourth of the entire rural white population being of these stocks.

In view of these facts, I can see no reason to be alarmed over

the rate of natural increase of the newer immigrants. They are not increasing as rapidly as the native and older immigrant peoples by excess of births over deaths. Although the relative rates of natural increase of the urban and rural population can not be calculated with exactness from the data given here, I have estimated them at 5 and 15, respectively. That is to say, in ten years the urban population would increase approximately 5 per cent., and the rural population 15 per cent. by natural increase. I believe that these estimates are conservative both with respect to the absolute rates in the two classes and with respect to the difference between these rates.

The reason for this difference between the rates of natural increase in the urban and rural population will be discussed in what follows.

REASONS FOR THE RATES OF NATURAL INCREASE OF THE DIFFERENT CLASSES IN OUR POPULATION

The reasons for the difference between the rates of natural increase in the urban and rural populations fall in two general classes: (1) Those which explain the difference in the death rates of these classes, and (2) those which explain the difference in the birth rates.

REASONS FOR THE DIFFERENCE IN DEATH RATES

The following table gives in very brief form the best data available regarding the difference between the death rates of our urban and rural populations:

NUMBER OF DEATHS PER ANNUM PER 1,000 PERSONS LIVING AT DIFFERENT
AGES FOR MALES AND FEMALES IN THE ORIGINAL REGISTRATION
STATES: 1910 (WHITES ONLY)

	Males		Females	
	Urban	Rural	Urban	Rural
Under 1 year of age.....	133.80	103.26	111.23	84.97
During tenth year of age.....	2.88	2.17	2.52	1.88
“ twentieth year of age.....	4.49	4.31	3.82	3.97
“ thirtieth year of age.....	6.83	5.33	6.08	5.44
“ fortieth year of age.....	11.61	6.90	8.58	6.53
“ fiftieth year of age.....	18.34	10.24	13.74	9.43
“ sixtieth year of age.....	36.07	21.19	28.65	18.72
“ seventieth year of age.....	69.42	48.79	59.16	45.12

This table shows that the death rates for both sexes are much lower in the country than in the city, with the exception that the death rate for women at about twenty years of age is

slightly higher in the country. It is worth noting too that the greatest excess of deaths in the cities occurs at the ages when the death rates are high. This would have the effect of raising the general death rate in the city much above that of the country. The general death rate in the country is probably about 13 per 1,000 per annum, while the general death rate in the cities is not less than 16 or 17 per 1,000. Thus if the country and city had the same birth rates, the country population would increase 3 or 4 per cent. more in ten years than the city population.

The outdoor life of country people is one of the important factors in keeping the rural death rate down. Country children spend most of their waking time, outside of school hours, out in the open. In going to and coming from school, at their chores and during their vacations country children get an abundance of good fresh air. They do not know what it is to breathe the dust- and germ-laden air which the city child must always breathe. The men spend even more of their time out in the open than the children. All their work takes them out into the sunshine and fresh air. They never feel the confinement of factories and stores, nor the blight of occupational diseases. They can not understand that work in reasonable quantity may be injurious to health, because they do not know the conditions under which many industrial workers ply their trades. The women, of course, do not live in the open as the children and men. But they get much out-of-door life during the warmer part of the year. They have their gardens to care for, the chickens to raise and many other light chores which take them out-of-doors. Besides if the country woman goes anywhere she does not go in a crowded street car. She is out in the open air in a buggy or automobile. There can be no doubt that the way of the country woman is more healthful.

There is room for much criticism of the country home because of its poor ventilation, lack of adequate heating and methods of sewage disposal. In spite of these deficiencies, however, there are very few country homes as unhealthful as the great number of tenement homes in the cities. The crowding of people together in small poorly ventilated and poorly lighted apartments, which is common among the lower classes of people in the larger cities, has no counterpart in the country. In hot weather when the city tenement dwellers suffer most from crowding and unsanitary living conditions, country people can get out-of-doors where there is always an abundance of fresh air and plenty of room for recreation. From whatever standpoint we contrast urban and rural conditions—from that of

conditions of work, from that of conditions of recreation and play, or from that of home conditions—we find that the out-of-doors, open-air life of country people gives them a decided advantage over city people in the matter of health.

Another reason for the lower death rate in the rural districts is that the country people are closer to the source of food and therefore have purer food than city people. In view of our present system of distribution it may seem to many that this is a relatively unimportant cause of better health in the country. It does not seem so to me, however. Country people have their own fresh vegetables in season and instead of buying canned vegetables for winter use put them up for themselves. They still raise much of their own meat—especially pork and poultry and veal. They also have eggs and milk and butter of the best and in abundance. Well-to-do people in the city can secure fresh and pure food, but the great majority of people have difficulty in doing so, as it is beyond their means. The very poor often use food which is entirely unfit for human consumption. The high death rate in this class is in part a result of this unhealthy diet.

In those classes in the city whose food is good there is a very large number of persons leading sedentary lives. These men are quite apt to overeat and underexercise, so that they do not use up their food and get rid of waste matter. The active life of the farmer, on the other hand, renders it unlikely that he will suffer from hearty eating. I have often been impressed by the fact that one sees many more soft flabby men among those pursuing sedentary occupations in the cities than among the farmers.

The relative security of the farmer's position is another reason for the low death rate in the country. He is not harassed by the uncertainty of his job and his income, as a great proportion of the salaried and wage-earning classes in the city. He does not need to fear that some machine will be invented to take his job, nor that he will be turned off in hard times because of lack of work. There is no danger that his industry will move away from him, forcing him to take up some new work or spend all of his savings to move his family to a new home. Nor do strikes and lock-outs affect the farmer in any appreciable degree. Besides, he does not have to compete with an ever renewed supply of immigrant laborers. The farmer has his "hard luck" as the city laborers, but it is not likely to force him into such dire straits as the former. If crops are a failure the whole neighborhood feels it, but no farmer is likely to lose

his position as a farmer because of that. He receives a temporary set-back and must curtail expenses, but he is in no danger of being in need of charity. This absence of worry on the part of the farmer no doubt helps to keep him healthy.

There is also very good reason to believe that the burden of accidents, industrial and other, falls more heavily on the city population than on the country population. Certain it is that a casual perusal of the daily papers leaves this impression. But more significant is the fact that it is the practise of insurance companies selling insurance to the lower classes in the cities, to charge them a much higher premium than they do farmers and those in other occupations. There seems to me to be no doubt that a part of the greater risk assumed in the case of hand laborers is due to the greater frequency of accident in this class.

Moreover, accidents in the city have more indirect effects contributing to a high death rate than they have in the country. Even with compensation from the employer, the city man's family is more likely to become destitute than the farmer's if he is injured. The farmer has more resources to fall back upon. For one thing the farmer's family is still an economic unit, in which each member, from a very early age, contributes something to the welfare of the whole, while in the city the workingman's family is very largely dependent upon him alone until the children are old enough to escape the provisions of the child labor laws. Besides even when the city boy can go to work, he can not at once take the place of his father, except in the unskilled occupations in which it is practically impossible for a man, single-handed, to make a living for himself and family. The farmer boy, on the other hand, can do his father's work in a pinch, and thus hold the fort until his father gets better. Even the wife and daughters can help in case of necessity and they often do. Then, too, neighborliness is more common in the country and can render greater assistance without savoring of charity than in the city. I would not imply that country people are naturally more kindly than city people, only that they live in such intimate daily relations that personal friendly aid of great value can be rendered in which there is no thought of condescension in the givers and no feeling of self-abasement in the recipients. Friendly aid of his neighbors has saved many a farmer from the worry of wondering how he was to care for his family during the coming winter. The city worker in the same situation would almost certainly have to look to charity to help him through. The different conditions of life make it

almost inevitable that accidents should entail more hardship and suffering on the workingman's family in the city than on the farmer's in the country.

Still another cause of the lower death rate in the country is what may be called the lower tension of competition in the rural districts. At whatever point one undertakes a comparison of urban and rural life with respect to the nature of their competitive processes, one finds a lower tension in the country.

For one thing, there is not the intense competition for place among men in the country that there is in the city. In the industrial and commercial world positions are graded so that there is always a more desirable one just ahead. This keeps the ambitious man continually striving for a better place and, since there are always more men who want the places just ahead than are needed to fill them, there is a constant struggle to secure them. There is no place one can stop to take a breath without fear that some one will step in ahead of him.

Among laboring men there is a somewhat similar process going on. Perhaps not quite so strenuous as among those in executive positions and the professions, but nevertheless quite strenuous enough to take a great deal of one's energies. There is the never-ending conflict of the skilled artisan with the machine designed to do his work; there is the constant change in methods and processes to which the man who has become settled in his habits finds it difficult to adjust himself; there is the competition between the immigrant and the unskilled worker, and to-day there is also the competition between men and women in numerous lines of work. All this striving for better places and to keep one's place is almost unknown in the country. The farmer may become old-fashioned and yet make a good living. He has very little need to fear that some one else can crowd him out if he does not want to go. And yet in many farming communities there is enough emulation to keep the farmer truly progressive.

Another way in which the difference between the country and the city in respect to competition manifests itself is in the attitude of the women toward dress. The continuous incitement to dress well and to vie with one's neighbors to which the city woman is subject is very largely lacking in the country. The city woman is forever seeing the new styles in the stores or on the streets, and she very soon comes to feel that she might just as well be out of the world as out-of-date. Besides in the city the success of the husband and the social position of the family are judged very largely by the outward show the family

makes. So "good-dressing" by the women is more than the satisfaction of personal vanity, it is the assertion of the right to a certain social position in the community. It is quite natural that this should be so in our modern cities, where people only know their neighbors by the clothes they wear and the automobiles they drive.

The country woman, on the other hand, does not need to assert her claims to a social position for the family by the way she and her daughters dress. Her neighbors know whether her husband owns his farm and whether he loans or borrows money. She can not impress her neighbors with outward show. In addition, the security of her position and in many cases the substantial prosperity of the family probably renders her more or less indifferent to the outward show of things. When people have back of them a secure and definite position in the community, they can afford to be less careful about the passing impressions they make. For this reason a majority of the farmers' wives care little about any luster they may add to the position of the family through the kind of competition for social position ordinarily practised by city people.

So it seems to me that from whatever angle we compare competition in the city and country, we find that the country requires less of its dwellers than the city and is therefore more favorable to good health.

(To be continued)

COAL MINING IN CHINA

By Dr. ALFRED C. REED

SAN FRANCISCO

THE great central valley of China, extending from Thibet in the far west to the Yellow Sea, is drained by the Yang Tze River and its tributaries. South of that part of the Yang Tze which flows through the mid-part of the eighteen provinces is a vast section centering in the province of Kiangsi and extending southward to the ranges cutting off the watershed of the South China coast, in which are some of the most extensive coal fields in the world. This southern watershed crosses the extreme south of Kiangsi and Hunan. Practically all of Kiangsi and the southern section of Hunan have large coal deposits as well as abundant iron and limestone, and more or less extensive quantities of antimony, manganese, lead, copper and silver.

The largest coal mine in China, the Ping Hsiang Colliery, was started in 1894 on the site of native diggings which had been worked for unknown ages near Ping Hsiang in Kiangsi. Five miles from this walled city is the village of An Yuen, the terminus of a railroad running to Changsha, the capital of Hunan. At this village, 90 miles from Changsha, is the Ping Hsiang Colliery, which produces 2,400 tons of coal and 700 tons of coke daily, and employs 9,000 men. An Yuen lies on the watershed between the Siangtung River running west into the Siang River in Hunan which empties through the Tung Ting Lake into the Yang Tze, and the Siu River running east into the Kan River in Kiangsi, which empties through the Poyang Lake into the Yang Tze. Southeast of the village is the high range of the Lo Siao Mountains in which are the coal fields. This range varies in altitude from one to two thousand feet, and the main level of the colliery in the valley is about 500 feet above the sea-level at Shanghai. The Ping Hsiang colliery is in east longitude 114 degrees and in north latitude 27 degrees and 30 minutes. The one way of approach is through Hunan where large river steamers from Hankow reach Changsha. The railroad from Changsha to An Yuen is part of the Canton-Hankow system which originally was an American concession, but later was transferred to the British. Only this section, with short spurs

at either end from Hankow and Canton, has so far been completed after many years of wordy strife and paper planning. A new British concession has, however, been granted to connect Changsha with Ningpo by way of Ping Hsiang, with a branch midway to Hankow. This would open up vast deposits of coal and iron now practically inaccessible.

The Ping Hsiang Colliery supplies the coke for the Hanyang Iron Works, which are across the mouth of the Han River from Hankow. The coal output is distributed to the territory from Changsha and Siangtan to Hankow and even further down the Yang Tze. Both coke and coal are transported by rail from An Yuen to Chuchow on the Siang River, where they are loaded on junks and lighters for further transportation. The technical operation of the Ping Hsiang colliery is under the direction of a



staff of twelve German engineers who are applying the most up-to-date methods of mining and coal preparation. In its twenty years under foreign supervision the colliery has grown to extensive proportions. Improvements now under construction will within six months increase the output to 3,500 tons per day. Entrance to the mine is twofold, first, by way of the main adit going straight into the mountain for a distance of 2,500 meters horizontally from the floor of the valley, and second, by a pair of shafts 300 and 500 feet deep, respectively. The shaft division is the older and smaller and its output is about 700 tons per day. It includes only the deeper levels where the seams dip below the level of the main adit. The bulk of the mine, reached through the main adit, is above the level of the valley floor and comprises a total of five levels, each with numerous lateral drifts following in each seam. The highest level is near the summit of the chief mountain of the range, and egress to the outer air could easily be obtained at many points.

The main adit runs straight into the mountain for a distance of 2,000 meters before reaching the main or lowest level, where a wide haulage way runs at right angles to it. The adit has two parallel tracks for an electric tramway running its full length, which in the outer 200 meters are increased to eight tracks. Here the first electric railway in China was put into operation fifteen years ago, and has been maintained ever since. The trains attain a speed of twenty-five miles per hour.



SKETCH MAP OF THE PROVINCES OF HUNAN AND KIANGSI.



ADMINISTRATION BUILDING, PING HSIANG COLLIERY.

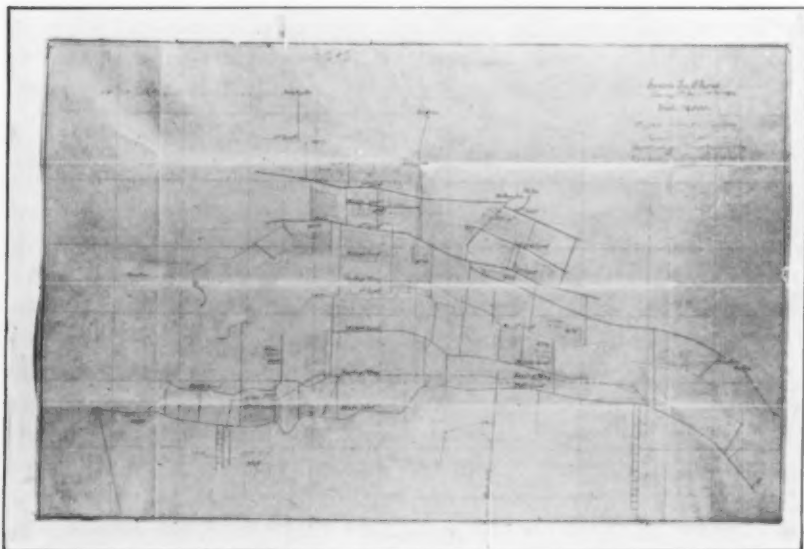
The coal seams run in three groups. The first group encountered by the main adit has the thickest seams and these are inclined at an angle of twenty degrees to the adit. At the junction of the adit and first group of coal veins is the main level of the mine running transversely to the adit, with lateral drifts following the seam up and down according to its inclination. Five hundred meters past the point where it pierces the first group of coal veins, the main adit pierces a second and smaller group inclined also at an angle of twenty degrees and parallel to the first group. Still deeper in the mountain is a third group which has been worked out.

The seams are thus all transverse to the main adit and inclined upward and away from it at a 20-degree angle. Lateral inclined drifts from the main level follow up each seam for from 120 to 160 meters to the first level, which runs horizontally in the plane of the seams, and in turn has lateral inclined drifts following the seams. The first level is connected with the main level not only by the inclined drifts following the seams, but also by vertical shafts. Higher yet in the line of the seams are the second, third and fourth levels, the last being well toward the summit of the range. The accompanying sketches show the inclination of the seams and the general schematic relations of the main adit and shaft to the various levels.

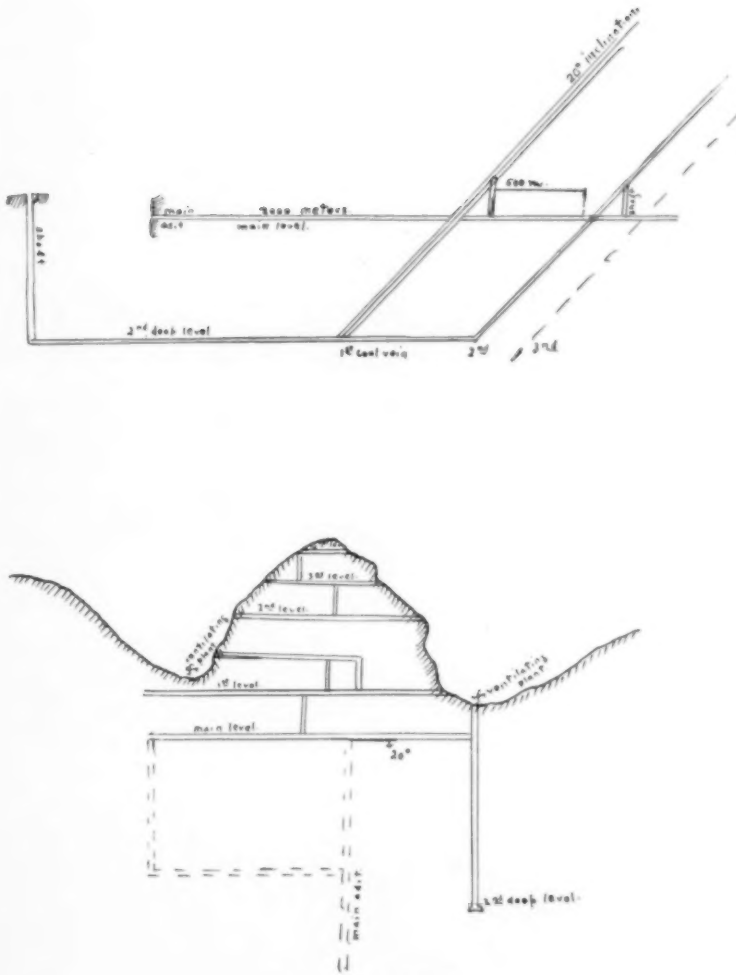
Below the level of the main adit there are two deep levels, communicating with the main level, but with haulage ways tributary to the double shaft. The arrangement of these deep levels

and the manner of communication between them, by means of lateral inclined drifts in the seams, are similar to the arrangement in the upper levels. The general lay-out of the mine as well as its operation is simplified by the fact that the two groups of coal veins, a little below the main level, are turned at an angle of 90 degrees still however maintaining their original inclination. This enables the combination of approach by a shaft and by a horizontal main adit to be most effective and also facilitates the ventilation. At present the ventilation is maintained by a combination of compressed air piped throughout the mine, together with two large air-heating furnaces which establish a strong upward draft. A new system of electric blowers is now being installed. The ventilation is remarkably good for so extensive a field of operation.

Among the drawbacks are the prevalence of mine fires, which are controlled by sealing off the entire section with several meters of wet clay, and faults in the strata which occur at various points and necessitate abrupt changes in drifts and elevations. A picture is shown herewith which illustrates a fault where the strata have not been broken, but have been bent through an angle of 90 degrees. The equipment for fighting mine-gas and fires is the same as in western countries and oxygen helmets are always at hand in the two rescue stations for emergencies.



THE LACHOW SEAM OF THE PING HSIANG COLLIERY. The drawing is not sufficiently clear to give a good reproduction, but the general arrangement of the levels is shown.



ELEVATIONS OF MINE.

Throughout the mine heavy timbering is necessary, and this constitutes one of the chief items of operating expense. In the seams and in very soft strata, a layer of pine twigs and straw is placed between the wall and roof and the heavy timbering to prevent coal dust and sand from working between the timbers and producing excavations of constantly growing proportions. With these fagots of twigs and straw countless insects are brought in. Scorpions six inches in length are fairly common but stings are infrequent. Cockroaches swarm by the millions and furnish part of the regular diet of the hosts of rats which find in the warm dark mine a safe abiding-place. Ants also are a great annoyance to the miners.



ELECTRIC LOCOMOTIVE, MANUFACTURED AND USED IN PING HSIANG COLLIERY.

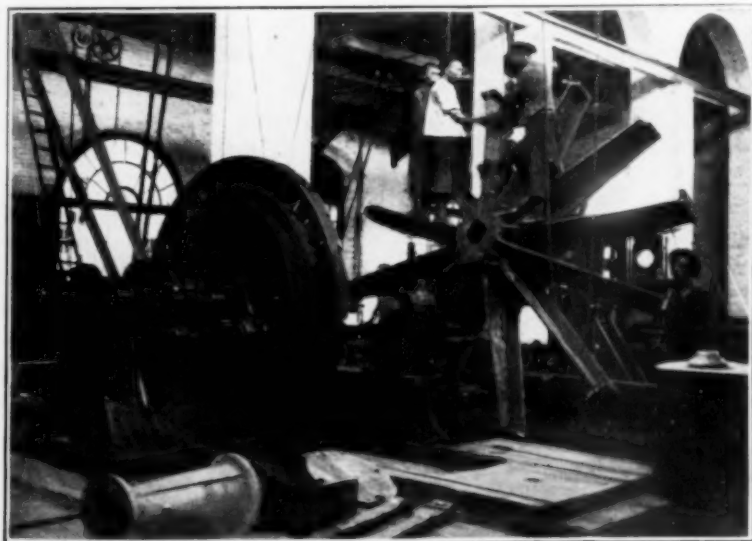
The above-ground works of the Ping Hsiang Colliery are extensive and modern. The freshly mined coal is taken on the tram-ways directly to the two washing plants, one for the shaft and one for the main adit. Here it is elevated to the top of the building, thoroughly mixed with water, cleaned, separated from slate, schist, clay and sand, and graded into various sizes. As only bituminous coal occurs, a large percentage is in the form of dust, and this is washed as thin slime into large sedimentation tanks thirty-five feet in depth. From the bottom of these tanks it is scraped by chain elevators, and deposited in storage tanks from which it is carried as a wet solid mass to the coke ovens. No anthracite is found and the soft coal is of such quality as to produce coke of the best quality, of excellent hardness and which fractures in large pieces, considerations of importance in the steel manufactory.

The foreign coke ovens number 262, each of which produces five tons of coke every forty-eight hours, giving a total output of about 700 tons of coke per day. Part of the gas from the coke ovens is used for developing electric power, but so far no other utilization of by-products has been introduced. There is a shameful waste here, as one ton of coal produces during the carbonizing process about 10,000 cubic feet of gas, fifteen to twenty-five pounds of ammonium sulphate, and from four to eight gallons of tar. But capital is hard to secure in central China and

the cost of the machinery installation necessary to secure these by-products is estimated at a million dollars gold.

Large and well-equipped machine shops turn out most of the machinery used in the colliery, including engines, pumps and tools. Many of the shop lathes and drilling machines were made here. All the car wheels and other castings necessary in so large a plant are cast in the local foundry. Electric power is developed for all purposes in the colliery. Another industry within an industry is found at the large brick yards on the mountain side not far from the colliery. Here the clay is pressed by hand and kiln-dried. The bricks are carried to all parts of the mine by coolies.

A total of nearly 9,000 men are employed, of whom about 6,000 work underground. Two shifts are run of twelve hours each. Work is suspended, not on Sundays, but on the first and fifteenth of each month. The coolies who work underground are divided into gangs of from ten to a hundred men each, according to the situation of their work. Each gang has its headman. About ten gangs, depending on their size, make up a section. Each tram-car of coal which leaves the mine is marked with the number of the gang which mined it and is credited to that gang. In drifts through rock and earth, the gang is paid according to meter of length and according to whether the drift is of single, or double, track caliber. A single track drift has a cross section of about 2.5 square meters. The absolute size of



MACHINE SHOPS. LARGEST SINGLE CASTING MADE AT PING HSIANG COLLIERY.



END OF A DRIFT.

the drift is determined by the amount of air which must pass through it for efficient ventilation.

No coolie will do more than one kind of work. One set does timbering alone. Another cuts coal. Another does the carrying in baskets, and pushing the tram-cars in drifts not fitted with electric or cable propulsion. Next come the miners who do the coal and rock cutting, then the coolies who scrape the coal and *débris* into baskets and carry it out. It is a strange fact that the shovel is unknown in China. Everywhere and for every purpose for which a western laborer would use a shovel the coolie uses an implement half between a mattock and a hoe, with which he scrapes the earth or whatever it may be into shallow baskets. The wage of the mine coolies averages twenty cents Mex., about nine cents gold, per day; the miners about thirty cents, thirteen cents gold; for the twelve-hour shift. The coolies live in company boarding houses where they are a little better under control. The cost per man for board and lodging is about eight cents Mex. per day, to which must be added four and one half cents per day for oil for lights in the mine. The total expense to the company is thus between forty-five and fifty cents Mex. per day for each coolie. Each section in the mine has four overseers, including one apprentice. Every effort is made by the foreign staff to develop native mining engineers and to this end apprentices are employed throughout the works, who later receive both theoretical and practical instruction in mining engineering and foreign languages.

The output of coal per miner is somewhat under one half ton per day in distinction to the European average of one ton per day and more, and this is in spite or perhaps partly because of the long hours and infrequent holidays. Indeed many factors contribute to this result, among which may be mentioned very prominently the presence of hookworm infection in high degree. The mine coolies are much better housed and fed by the company than if left to their own resources, but their physical capacity is quite limited. The methods of drilling and blasting are similar to those in western countries.

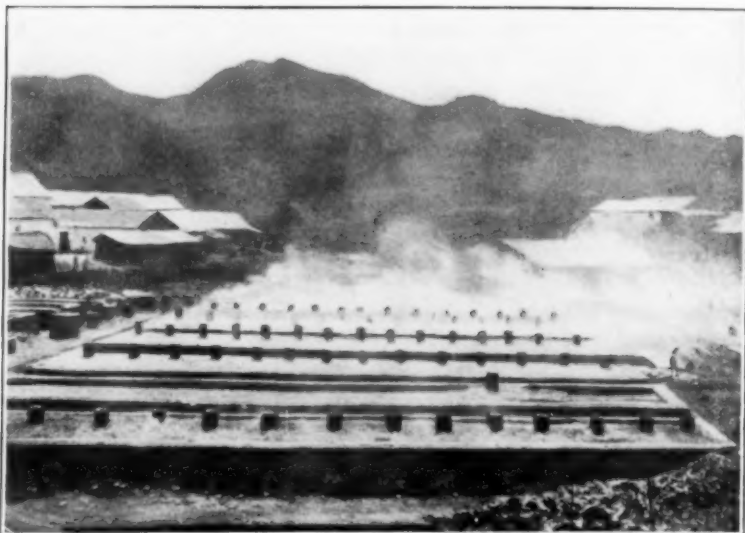
The coolie class is intractable, unreliable, and has no outlook either as to their own or their country's future. They reflect in a petty way the same qualities which now and always have been too much in evidence among their countrymen in higher circles. "Face," "squeeze" and dishonesty are the crying vices of the Chinese people, and it is these particular qualities which make foreign development of China most difficult and which make absolutely imperative an actual and effective supervision of foreign loans to China.

Just south of the washing plants and coke-burning kilns of the Ping Hsiang Colliery is an area of perhaps five acres enclosed by a high brick wall and given over to coke production according to native methods. The "beehive," or native ovens, differ radically from the foreign and no machinery is used in filling or emptying them. The human beast of burden does



A FAULT, IN WHICH THE STRATA ARE BENT BUT NOT BROKEN. Photograph in Ping Hsiang Colliery.

everything by simple force of numbers and persistence. The native kiln is constructed in a unique but effective manner. A long trench is formed about 12 feet wide and from 20 to 50 yards in length, by two brick walls some 30 inches in height. These retaining walls are about the thickness of two brick lengths, and at intervals of perhaps 8 feet are fitted with apertures a foot wide by 18 inches high through which the firing is started.



NATIVE "BEEHIVE" COKE OVENS BURNING. Coal-bearing range in background.

These broad and comparatively shallow trenches are provided with a smooth floor of packed clay and are then filled solid with wet coal dust except for a small space left opposite each aperture in the retaining walls. Every bit of the coal is carried by coolies in small baskets balanced on poles across the shoulders. The coal is of first quality, coming from the washing plants of the Ping Hsiang colliery. The trenches are filled to a depth of two and a half feet and then rows of brick are laid on edge over the entire surface, and on these a second layer of brick are laid flat covering the entire space. Along the center of the trench at points midway between the firing apertures in the retaining walls, small flues are made with brick, and then the entire surface is covered with sand. By means of a little lump coal and wood, fires are now started in each of the firing apertures, and soon the entire interior of the trench, forming a single long low kiln, is in process of combustion. A good draught is

quickly established between the firing apertures and the flues, and the gases are quite thoroughly consumed. From the entire area a thin cloud of smoke and vapor rises, but there is remarkably little unoxidized material. The heat evolved is a total waste except for its value for the coolies' cooking.

Even more interesting than the "beehive" coke ovens are the native coal mines, of which there are large numbers in southern Hunan and southwestern Kiangsi. In the coal fields near Ping Hsiang there are numerous native mines on both sides of the range. These native mines are a sore grievance to the Ping Hsiang colliery because of drainage conditions. The native mines are always located where the coal seams pinch out at the surface, and are always comparatively shallow, seldom extending more than a few hundred feet into the mountain. Their slanting shafts quite thoroughly collect most of the surface waters which are held above the clay strata overlying the deeper drifts of the large colliery. The upper levels of the colliery naturally approach nearest the surface at the localities where the coal seams outcrop. The result is that the surface waters collected in large quantity by the native mines are drained off to a great degree by the upper levels and drifts of the colliery and these highest parts of the colliery are consequently the wettest by far. The native mines are frequently however in a state of practical flood. The description here given is based on an extensive investigation covering upwards of 200 native mines, undertaken by Mr. M. Esterer, of the Ping Hsiang Colliery.

In digging shafts and laterals, the native miner avoids rock so far as possible, though he has copied foreign methods of drilling and blasting. The diggings are largely in the seams and consequently have many tortuous and narrow passages. The shaft of the native mine follows the vein from the surface, usually at an inclination of from 20 to 60 degrees. After a varying distance the shaft or drift becomes horizontal and then rises, still following the vein. The result is the formation of an elbow towards which the water flows from both directions. This necessitates constant pumping to keep the passage open, and even then the water stands from one to two feet deep for a variable distance. Through this water every person must walk on entering and leaving the mine. Pumping is effected by manpower, as machinery is never used. A long section of a large bamboo, 6 to 8 inches in diameter, is cleaned out, making a circular smooth pipe. Into one end of this a crude valve is fitted and into the opposite end is introduced a piston with valve. This pump is laid along the slanting floor of the shaft and



MR. CHÁNG. Chinese Founder of Ping Hsiang Colliery.

operated by a coolie who sits at its upper extremity. The water is caught in a small pool lined with clay from which it is pumped by a second similar apparatus at a higher level. A sufficient number of these relay bamboo pumps are provided to reach the surface.

As the shafts are never vertical and all work is done by man-labor, some special means is necessary for transporting the coal to the surface. Bamboo or plain wooden ladders with the rungs characteristically close together, so that each step is not over 6 to 10 inches, are laid against the sloping floor and secured by pegs or bamboo withes. The upright side pieces of these ladders are very close together, leaving not more than 6 to 8 inches

for the feet to tread. Coal, earth and rock are scraped into small baskets which are pulled by ropes by a coolie who mounts on the rungs of the ladder, with the basket sliding on the side-bars after him. The coal is deposited in a heap at the pit mouth and carried thence in baskets by coolies again to Ping Hsiang or some point on the river where it can be placed in junks.

The native mines are insufferably hot, due to the entire absence of any ventilation system, to the small caliber and single bore of the shafts, and to the large number of persons at work in the mines at once. The average is 30 to 35 degrees Centigrade. This temperature, with the darkness and abundant moisture, favors the growth of parasites such as the hookworm, which here finds ideal conditions for propagation. Some of these mines have a daily output of 30 to 40 tons, but most are much smaller. The coal districts are thickly dotted with native mines, but all are most superficial, and where the seams dip away from the surface they have not been touched. No natural gas or oil has so far been found in the south Yang Tze coal fields, but no deep borings have as yet been made.

THE HEALTHIEST OF MEN

By Dr. JAMES FREDERICK ROGERS

NEW HAVEN, CONN.

“**W**ERE one to preach a sermon on Health, as really were worth doing,” said Thomas Carlyle, “Scott ought to be the text,” for Sir Walter was “an eminently well-conditioned man, healthy in body, healthy in soul; we will call him one of the healthiest of men. . . . On the whole, we might say,” that “in the new vesture of the nineteenth century” he “was intrinsically very much the old fighting Borderer of prior centuries. . . . In the saddle, with the foray-spear, he would have acquitted himself as he did at the desk with his pen. . . . He could have fought at Redswire, cracking crowns with the fiercest, if that had been the task; could have harried cattle in Tyndale, repaying injury with compound interest.” The author of “Ivanhoe” preached in his life a greater sermon on health than even Carlyle could have composed, and, fortunately, we have, straight from his own genial pen, many facts about his physical experiences and unfolding, with additional interesting details from that of his son-in-law, Lockhart.

Like some other giants of literature—Johnson, Gibbon and Dickens—this healthiest of men did not make a very heroic start in life. Scott says:

I showed every sign of health and strength until I was about eighteen months old. One night, I have been told, I showed great reluctance to be caught and put to bed, and after being chased about the room, was apprehended and consigned to my dormitory with some difficulty. It was the last time I was to show such personal agility. In the morning I was discovered to be affected with the fever which often accompanies the cutting of large teeth. It held on three days. On the fourth when they went to bathe me as usual, they discovered that I had lost the power of my right leg. . . . There appeared to be no dislocation or sprain; blisters and other topical remedies were applied in vain.

The disease was (according to Dr. Charles Creighton) an inflammation of the bones of the leg just above the ankle, which, from its painfulness, prohibited its use at the time, and interfered with its complete growth later. Scott continues:

My anxious parent during the course of many years, eagerly grasped at every prospect of cure which was held out by the promise of empirics,

or of ancient ladies or gentlemen who conceived themselves entitled to recommend various remedies, some of which were of a nature sufficiently singular. But the advice of my grandfather, Dr. Rutherford, that I should be sent to reside in the country, to give the chance of natural exertion, excited by free air and liberty, was first resorted to; and before I have the recollection of the slightest event, I was, agreeably to this friendly counsel, an inmate in the farmhouse of Sandy-Knowe. . . . Among the odd remedies recurred to aid my lameness, some one had recommended that so often as a sheep was killed for the use of the family, I should be stripped, and swathed up in the skin, warm as it was flayed from the carcass of the animal. . . .

I was in my fourth year when my father was advised that the Bath waters might be of some advantage to my lameness. . . . My health was by this time a good deal confirmed by the country air, and the influence of that imperceptible and unfatiguing exercise to which the good sense of my grandfather had subjected me; for when the day was fine I was usually carried out and laid down beside the old shepherd, among the crags or rocks round which he fed his sheep. The impatience of a child soon inclined me to struggle with my infirmity, and I began, by degrees, to stand, to walk, and to run. Although the limb affected was much shrunk and contracted, my general health . . . was much strengthened by being frequently in the open air, and, in a word, I, who, in a city, had probably been condemned to hopeless and helpless decrepitude, was now a healthy, high-spirited, and, my lameness apart, a sturdy child.

An illness or accident is sometimes a blessing in disguise, and possibly had Sir Walter not been so crippled in his early years he might not have been led into his love of books nor have drunk in the tales of romance from the lips of the country folk with whom his lameness had thrown him. He learned also the lure of the historic country where he lived which later sent him on many a pedestrian tour in which he unconsciously collected the material for his future works. As Carlyle puts it,

Disease, which is superficial, and issues in outward "lameness" does not cloud the young existence; rather, forwards it towards the expression it was fitted for.

His mind became strong on the varied food it gathered from every source, but his body did not yet give promise of much vigor. His attendance at school was consequently irregular, but though he was poor in some studies he was "neither a dunce nor an idler." Along the lines of his own bent he was "one who wished to know and will know everything." He says:

At the age of sixteen my health, which, from rapid growth and other causes, had been hitherto rather uncertain and delicate, was affected by the breaking of a blood vessel. The regimen I had to undergo on this occasion was far from agreeable. It was spring, and the weather raw and cold, yet I was confined to bed with a single blanket, and bled and blistered till I scarcely had a pulse left. I had all the appetite of a growing boy, but was prohibited any sustenance beyond what was absolutely neces-

sary for the support of nature, and that in vegetables alone. Above all, with a considerable disposition to talk, I was not permitted to open my lips without one or two old ladies who watched my couch being ready at once to souse me,

"imposing silence, with a stilly sound."

Lockhart says the bleeding was from a vessel of the bowel and that "his uncle, Dr. Rutherford, considered his recovery from it as little less than miraculous. His sweet temper and calm courage were no doubt important elements of safety." Waverly continues:

My constitution recovered from the injury it had sustained, though for several months afterwards I was restricted to a severe vegetable diet . . . and though I gained health under this necessary restriction, yet it was far from being agreeable to me, and I was affected whilst under its influence with a nervousness which I never felt before or since. A disposition to start upon slight alarms—a want of decision in feeling and acting, which has not usually been my failing—and acute sensibility to trifling inconvenience—and an unnecessary apprehension of contingent misfortunes, rise to my memory as connected with my vegetable diet, although they may have been entirely the result of the disorder and not of the cure. Be this as it may, with this illness I bid farewell both to disease and medicine, for since that time, till the hour I am now writing (he had reached 36 years) I have enjoyed a state of the most robust health, having only had a complaint of occasional headaches or stomachic affections when I have been long without taking exercise, or have lived too convivially—the latter having been occasionally, though not habitually, the error of my youth, as the former has been of my advanced life.

My frame gradually became hardened with my constitution, and being both tall and muscular, I was rather disfigured than disabled by my lameness. This personal disadvantage did not prevent me from taking much exercise on horseback, and making long journeys on foot, in the course of which I often walked from twenty to thirty miles a day without fatigue. Wood, water and wilderness had an inexpressible charm for me.

His biographer adds,

He partook profusely in the juvenile bacchanalia of that day, and continued . . . down to the time of his marriage. . . . No man in mature life was, however, more habitually averse to every form of intemperance. He could, when I first knew him, swallow a great quantity of wine without being at all visibly disordered by it, but nothing short of some very particular occasion could ever induce him to put this strength of head to a trial, and I have heard him say many times: "Depend upon it, of all vices, drinking is the most incompatible with greatness."

He wrote to his son:

Even drinking what is called a certain quantity every day, hurts the stomach.

If, as a young man, he followed the convivial habits of those about him, he had no vices. He used tobacco very moderately, but at fifty-four he wrote:

I have given up cigars and have no wish to return to the habit.

It was when he entered on his life's work that he fully appreciated his health and strength. He knew the need for temperance in meats and drinks and for muscular exercise, and until the avalanche of debt plunged him in ceaseless toil with his pen, he maintained both.

He did most of his literary work before breakfast and this became his chief meal. Says Lockhart:

No fox hunter ever prepared himself for the field with more substantial appliances. His table was always provided, in addition to the usually plentiful delicacies of a Scotch breakfast, with some solid article, on which he did most lusty execution—a round of beef—a pasty, such as made Gil Blas' eyes water, or, most welcome of all, a cold sheep's head. . . . A huge brown loaf flanked his elbow. . . . But this robust supply would have served him in fact for the day. He never tasted anything more before dinner, and at dinner he ate sparingly."

Sir Walter's financial difficulties began when he was forty-one, and between these and his ambition to establish a magnificent house at Abbotsford, he found himself led into an intemperance in work that sorely tried even his extraordinary powers. His literary labor, large as it was, was but a part of his daily work. That was disposed of by early rising, before breakfast, and at odd moments.

The immense strain of Scott's double or quadruple life as sheriff and clerk, hospitable laird, poet, novelist and miscellaneous man of letters, publisher and printer, though the prosperous excitement sustained him for a time, soon told upon his health.

At the age of forty-five he was visited "for the first time since his childish years with a painful illness." His pushing of "his liberties with a most robust constitution to a perilous extreme while the affairs of the Ballantynes were laboring" had brought their penalty. Four years before he had advised Mr. Ballantyne:

You must positively put yourself on a regimen as to eating, not for a month or two, but for a year at least, and take regular exercise. . . . I know this myself, for if I were to eat and drink in town as I do here, it would soon finish me, and yet I am sensible I live too genially in Edinburgh as it is. I take enough of exercise and enough of rest, but unluckily they are like a Lapland year, divided as one night and one day. In vacation I never sit down; in the session time I seldom rise up.

A cramp in the stomach, which, after various painful visits, as if it had been sent by Prospero, and had mistaken me for Caliban, at length chose to set fire to its lodging like the Frenchmen as they retreated from Russia.

For the inflammation thus set up "bleeding and blistering was the word; and they bled and blistered till they left me neither skin nor blood."

To aching eyes each landscape lowers,
To feverish pulse each gale blows chill;
And Araby's or Eden's bowers
Were barren as this moorland hill.

"Rob Roy" was written this same year, and,

With returns of his cramps it had been a "tough job"—for lightly and airily as it reads, the author had struggled almost throughout with the pains, or the depressing effect of the opium taken for their relief. Calling on him one day to dun him for copy, James Ballantyne found him with a clean pen and a blank sheet before him, and uttered some rather solemn exclamation of surprise. "Ay, Ay, Jemmy," said Scott, "'tis easy for you to bid me get on, but how the deuce can I make Rob Roy's wife speak, with such a curmurring in my guts?"

He struggled to recover his loss of health, and the next year writes:

I have taken hard exercise with good effect and am often six hours on foot without stopping or sitting down.

But at forty-seven his health was still "very totterish." His last attack of colic ended in jaundice,

so that I might sit for the image of Plutus, the god of specie, so far as complexion goes. . . . If I had not the strength of a team of horses, I could never have fought through it, and through the heavy firing of medical artillery, scarce less exhausting—for bleeding, blistering, calomel and ipecacuanha have gone on without intermission.

The following year his health seemed quite restored. As a boy he "climbed like a wild cat" and his venturesomeness remained, for he writes in his journal:

Please God, I will be on the roof of the old Abbey (Melrose) when the scaffolding is up.

At fifty his favorite exercise was in wielding the axe, and none of his woodmen excelled him in bringing down a tree with the fewest possible strokes.

In 1825, in the midst of apparent prosperity, he was plunged by the failure of the publishing firm with which he was connected, into the worry and Herculean labors of trying to pay his creditors their due of \$750,000. Under this added strain he felt keenly any signs of bodily failure. Reminiscently he writes:

My early lameness considered, it was impossible for a man to have been stronger or more active than I have been, and that for twenty or thirty years. Seams will slit, and elbows will out, quoth the tailor; and as I was fifty-four 15 August last, my mortal vestments are none the newest.—Bodily health is the mainspring of the microcosm. . . . What poor things does a fever fit or an overflowing of bile make of the master of creation.—What a detestable feeling this fluttering of the heart is! I know it is nothing organic, and that it is entirely nervous; but the

sickening effects of it are dispiriting to a degree. Is it the body brings it on the mind, or the mind that inflicts it on the body? . . . As to body and mind, I fancy I might as well inquire whether the fiddle or fiddle-stick makes the tune.

During the following winter 1826-27, Sir Walter suffered great pain, but he was as stout of heart as any of the heroes of his romances, and, the following year, he writes:

There is a touch of the old spirit in me yet, that bids me brave the tempest—the spirit that in spite of manifold infirmities (of my childhood) made me a roaring boy in my youth, a desperate climber, a bold rider, a deep drinker, and a stout player at single stick, of all which valuable qualities there are now but slender remains.

At fifty-eight came the first stroke of apoplexy from which he quickly recovered, but other attacks soon followed, and the giant who, as a young man, "could lift a smith's anvil with one hand—by what is called the horn," and who once fought three highwaymen for an hour, found himself "if not quite unable to write" yet "unfit to do it. . . . A total prostration of bodily strength is my chief complaint. I can not walk half a mile. There is besides some mental confusion." At sixty came a more severe shock, "the crowning blow" which was followed by his death in the ensuing year.

In the years of his physical perfection Scott

had a fresh, and brilliant complexion. His eyes were clear, open and well set, with a changeful radiance, to which teeth of the most perfect regularity and whiteness lent their assistance, while the noble expanse and elevation of the brow, gave to the whole aspect a dignity far above the charm of mere features. His smile was always delightful. . . . His figure, excepting the blemish in one limb, was eminently handsome; tall, much above the usual standard, it was cast in the very mold of a young Hercules; the head set on with singular grace, the throat and chest after the truest model of the antique, the hands delicately finished; the whole outline that of extraordinary vigor, without as yet a touch of clumsiness.

The sermon on health preached in his life by Waverly needs no commentary. Like all really great men, he was fully aware of the preciousness of his physical powers. Only six years before his death he writes:

I have perhaps all my life set an undue value on these gifts. Yet it does appear to me that high and independent feelings are naturally, though not uniformly or inseparably connected with bodily advantage. Strong men are usually good humored, and active men often display the same elasticity of mind as of body.

Carlyle, not without some warrant, bitterly scored his abuse (a conscious abuse) of his powers for the purpose of setting up a great house, but had the publishing concerns in the failure of

which he was involved been more carefully conducted, he would never have been shouldered with the extra worry and work which hastened his bodily dissolution. Had he been less strong morally and refused to shoulder his enormous weight of debt it had gone differently with his health of body. The abuse of health for mere accumulation of earthly goods and earthly repute is to be condemned, but the shortening of one's life to the end that others may have their rights and their just dues, marks the man as the hero, and the greater the bodily gifts which he sacrifices the greater his heroism. If Scott sinned in taxing his body unnecessarily for attaining wealth and prosperity he made up for it by the greater gift of all his powers to make good the results of commercial errors in which he shared only in name. In meeting the claims of his creditors "he paid the penalty of health and life." He was as heroic in soul as in body, and the greater, because of the greatness of his bodily sacrifice.

EUGENICS OF THE NEGRO RACE

By Professor KELLY MILLER

DEAN OF THE COLLEGE OF ARTS AND SCIENCES, HOWARD UNIVERSITY

THE problem of *eugenics* is receiving much attention from students of sociology at the present time. The future welfare of society depends very largely upon perpetuating and carrying forward the best characteristics derivable from physical heredity and social environment. The application of eugenics to the colored race of the United States suggests several new and interesting lines of inquiry.

A study of the number of children, contributed by the fifty-five colored teachers in Howard University, Washington, D. C., throws an interesting sidelight on the question of eugenics as it affects the negro race. Howard University is an institution for the higher education of the negro, comprising a student body of over fifteen hundred. The negro members of the faculty maintain, on the whole, perhaps, a status as high as any other group of colored people to be found in the United States. The present study is limited to the teachers of the academic faculties, as they constitute a coherent social entity, whose life focuses about the institution.

As outgrowth of sudden change of condition due to the Civil War, the negro has developed a small upper class with a wide fissure between it and the great mass life of the race. There are about fifty thousand negroes belonging to the professional class, who earn a livelihood by some form of intellectual endeavor; while the great bulk of the race lives mainly by manual exertion. All social stratification rests ultimately upon occupation. The negro has no considerable middle class, such as is found in well-regulated societies, which shades imperceptibly in both directions. According to the occupational test, the demarcation between the professional and laboring classes of the negro is as sharp as a knife-cut line.

It becomes a matter of sociological interest to know how far this upper class is self-sustaining through its own reproductivity. I have therefore undertaken to make a study of race eugenics in so far as this particular group is concerned. In the fifty-five families from which these teachers were derived, there were 363 children, or an average of 6.5 for each family. On the other hand, these fifty-five teachers who have passed from the lower to the upper section of negro life, have, so far, contributed

only 37 children, or an average of .7 for each potential family involved. Of this number there are 41 males, 14 females; 22 are married, and 33 are single; the number of children for each family so far formed is 1.6; the largest number of children in any family is 6; four of the families are barren and four have one child each. The average age of the single members is over 32 years. This strongly indicates that the upward struggle defers the age of marriage to a time when only limited progeny might be expected. Considering all the probabilities in the case, it seems to me entirely likely that these fifty-five potential families, when the whole record is in, will not produce more than an average of two children to each family, while the fifty-five parent families, under the old régime, gave rise to 363 children. The new issue will scarcely produce sufficient progeny to perpetuate its own numbers.

There is always a certain sort of social restraint, in the case of an individual advancing from a lower to a higher level of life. The first descendants of foreigners in this country have a lower birth rate than any other element of our population. The intolerant social environment created by the white race may also produce a strong deterrent influence. Animals, in captivity or under restrained environment, do not breed as freely as when placed under free and normal surroundings. The educated negro, especially when submerged in a white environment, is under a sort of social captivity. The effect of this psychophysical factor upon reproductivity awaits further and fuller study, both in its biological and psychological aspects.

From a wide acquaintance with the upper life of the negro race, under wide variety of conditions and circumstances, I am fully persuaded that this Howard University group is typical of like element throughout the race so far as fecundity is concerned. The upper class is headed towards extinction, unless reinforced from the fruitful mass below. It is doubtless true that the same restraining influence is exerted upon the corresponding element of the white race. But as there is not the same sharpness of separation between the social levels, nor such severe transitional struggle, the contributing causes do not perhaps operate with the same degree of intensity.

The prolonged period of education delays the age of marriage. The negro during the first generation of freedom acquired his education at a later period than the white children and by reason of the hard struggle he has had to undergo, his scholastic training was completed at a somewhat advanced age. The high standard of living, which the professional negro feels he must maintain, still further delays the age of marriage. A

single illustration will serve to clarify this point. I half-jocularly asked one of our bachelor instructors, who has passed beyond his fortieth birthday, why he did not take unto himself a companion and help-mate. His reply was that his salary was not sufficient to allow him to support a family in the style and manner which he deemed appropriate. My reply was: "If your parents had been constrained by like consideration, you would probably not be in existence." His father was a laboring man with a family of eight children. It was the opinion of Grant Allen, the eminent English literary and scientific authority, that the human race would become extinct if all females deferred marriage beyond the age of twenty-six.

The conscious purpose of race suicide doubtless contributes somewhat to the low birth rate. There are some of sensitive and timid spirit who shirk the responsibility of parenthood, because they do not wish to bring into the world children to be subjected to the proscription and obloquy of the negro's social status.

Will this tendency, which threatens the extinction of the higher element of the negro race, continue to operate in the future with the same degree of intensity as at the present time? Probably not. The first generation after slavery was subjected to the severe strain and stress of rapid readjustment. The sudden leap from the lower to the upper levels of life was a feat of social acrobatics that can hardly be repeated under more orderly scheme of development. The life of subsequent generations will be better ordered, and therefore we may expect that the resulting effect will be seen in the family life. The birth rate of the mass of the race is not affected by like considerations. They feel little or nothing of the stress and strain of the upper class, and multiply and make merry, in blissful oblivion of these things. The rate of increase of the upper class is scarcely a third of that of the bulk of the race, as is clearly indicated by the relative prolificness of the Howard University faculty as compared with that of their parents. The higher or professional class in the negro race will not be recruited from within its own ranks, but must be reinforced from the great mass below. This will produce healthy current throughout the race which will serve somewhat to bridge the chasm produced by the absence of a mediatory class.

The whole question suggests the importance of a more careful and extended study in this field of inquiry which is as fruitful as any other in its far-reaching effect upon the general social welfare.

THE PRINCIPLES OF HUMAN PROGRESS

By Professor T. D. A. COCKERELL

UNIVERSITY OF COLORADO

LIFE is a phenomenon manifested only by and through protoplasm, a jelly-like substance having the physical properties of a liquid, forming the essential basis of all plants and animals. This protoplasm is a carbon compound, consisting of extremely complex molecules, which are continually in a state of change; yet it maintains its essential characters from generation to generation, and is, in a large sense, one of the most permanent substances in the world. In spite of the conservatism of this changeable substance, evolution has taken place. In the course of millions of years, millions of species of animals and plants, each having its own particular place in nature, have come into existence. All these species, and the divisions of species which we call varieties or races, have distinctive characters, which may with rare exceptions be observed in dead and preserved specimens. Such characters we call *morphological*. There are, however, other characters, the description of which is the function of physiology and psychology, which are dynamic rather than static; which can not be seen in preserved specimens, though they may often be inferred. Characters of this latter class are exhibited in the *reactions* of the organism to external and internal stimuli. Even such a regular process as the beating of the heart requires a stimulus, though this is furnished automatically.

When we regard vast periods of time, evolutionary progress can be readily appreciated; change seems to be the rule. Morphological, physiological and psychological characters have all gone into the melting-pot, to emerge in new forms and phases. Progress and life appear to be almost synonymous. Yet we find, on investigation, that the *tissues* out of which living things are made are extraordinarily permanent. So also are the *determiners*, the units in inheritance; while many species have existed untransformed for enormous periods.¹ The correlation of

¹ Pearl, quoting Loeb, states that Walcott found "that pre-Cambrian annelids, snails, crustaceans, and algæ were in many cases so like forms living to-day as to belong to the same genera." (*American Naturalist*, Feb., 1917, p. 90.) This is, of course, altogether incorrect.

evolutionary progress with *human* progress appears increasingly doubtful; the processes may not even be of the same nature. Even in those cases, such as the evening primroses of de Vries, where "mutation" is rampant, we find on analysis no real resemblance to human progress. The phenomena appear to need different designations, for which the current language is rather inadequate.

Forgetting the slow sweep of evolution, and dealing with short periods of time, we find that *species* are essentially static. Species, as we find them, *are*: they are not in process of becoming. As species, they ordinarily know nothing of progress. Man himself, in a wild state, remains unchanged for ages. The remoter regions of the Amazon harbor tribes who live like animals of the forest, and have no history. For them, one epoch, one century, is like another.

On the other hand, the *individual* is intensely dynamic. He is continually in process of becoming. For him, progress never ceases, though its rate rapidly decreases from the beginnings of life. The years, the days, all have their history, their succession of *different* events. For different individuals, the character and amount of this progress will differ, but none can escape the procession of events represented by physical growth, mental development coming from experience, and so forth.

Now we see that physiological characters, *regarded as specific*, have no more relation to progress than morphological ones. Lester Ward used to argue that physiology is not a dynamic science, because it is as it were an aspect or consequence of morphology. The *go* of the living thing is an individual *go*, not a specific one. It is not part of evolution.

Whence, then, comes human progress? How is it that the *species* *Homo sapiens* has taken on the dynamic features of the *individual*; has almost become a vast and long-lived individual? The various readjustments shown by animals and plants under new conditions do not offer parallel phenomena. They all represent movements toward new positions of stability. Human progress, instead of leading to stability, carries with it a principle of acceleration.

Mankind was well embarked on this new adventure before it was realized what was happening. It is not so very long ago that the idea of *necessary* progress was foreign to us. There was, indeed, a sense of *change*, and it was supposed that our species had fallen from some high estate. Eden knew no progress, it was a place of perpetual bliss, undisturbed by reformers. The fall was due to a centrifugal disturbance, diverting man

from his natural accustomed round. Once the circle had been broken, there was no return to the old state of affairs, and as a penalty for refusal to conform, conformity became forever impossible. The burden of sin could never be lifted from the species, but worthy individuals would pass after death into a sphere where the old uniformity, the old monotony, reigned once more. With the enormous growth of stored knowledge following the invention of printing and the revivification of science, together with the rapidly increasing exploration of every part of the world, progress became increasingly rapid. It began to be apparent that man had not merely lost his way; *he was going somewhere!* The appreciation of this stupendous fact was bound to change the whole intellectual and moral outlook. Social progress, really analogous to individual progress, had become the rule. Reformers were no longer trying to reverse the current, or to find a way out of the consequences of our first parents' disobedience. Joyfully, they took up the task of *raising* the species to that degree of maturity to which it was entitled. Whether, like a person, it must some day die, need not be considered. It was in any event destined to live far into the future, and to develop in ways beyond imagining.

It is interesting to note the gradual diffusion of the new point of view, even so recently as during the nineteenth century. The earlier reformers of that period were largely concerned with the removal of disabilities, with remedies for existing evils. Their main thought was to cure the patient, who was certainly in need of it. As the years wore on, the dominant attitude gradually shifted. The doctrine that the best government is that which makes itself least necessary was abandoned. *Laissez faire* gave way to *constructive* ideals, and while it remained necessary to combat evils, *development* became the leading purpose.

Progress beget progress. Each move forward disclosed fresh fields of opportunity, and those who neglected them found themselves abandoned by the moving social mass. To keep up with the procession was necessary, in order to retain the benefits of social life. Progress was no longer the fruit of idealism, it had acquired an ever increasing momentum of its own. Unfortunately, the speed of the several parts was extremely unequal, and serious dislocations resulted. Conservatives tried to hold back the advanced groups, radicals to spur on those who lagged. Their diagnosis of the trouble was exactly opposite. Yet in a sense both were right.

Thus the modern reformer, the modern progressive, is like

a man in a chariot pulled by many horses. He can not stop, he does not wish to—all he can do is to attempt to control the animals. This one must be held in, this encouraged by the whip; this held to the road, lest it upset the vehicle. He no longer says, with the philosophers of a mechanistic school, "let them go, they will go when they must!" He feels more and more his responsibility, and the need for controlling the processes which he can not and usually would not stop. For his guidance he appeals on the one hand to science, to the facts with which he has to deal—the structure of the vehicle and the nature of his beasts—on the other to his idealism, his innate feeling concerning the nature and proper destiny of man. He may make mistakes, but he knows that damnation equally with salvation lies on the road before him, and that he, and he alone, can determine which it shall be for him and his. Yet he feels that he is not alone in a deeper sense; he prays to his God, confident that there is something in the very structure of the universe which will uphold his arms.

Where is he going? Is there some haven of realized ideals, some ultimate goal of social stability and perfection? He does not know, but the wind blows in his face, and the dawn of a new day lights the eastern sky.

SOME OF THE NEWER CONCEPTIONS OF MILK IN ITS RELATION TO HEALTH

By Professor LEO F. RETTGER

SHEFFIELD SCIENTIFIC SCHOOL, YALE UNIVERSITY

MILK has been regarded from the earliest times as a most important article of food and, although little was known as to its chemical composition previous to the eighteenth century, the ancients attributed many and peculiar hidden virtues to it.

In 1911 ten billion gallons of milk were produced in the United States, one quarter of which was consumed as milk and the remaining three quarters as butter and cheese. Although milk and milk products constitute about 16 per cent. of the average dietary in this country, the average daily consumption of milk per capita is but 0.6 of a pint. The milk of goats and asses has found but little favor on this continent; in Asiatic and European countries, however, it is a common article of diet, particularly goat's milk.

The chemical composition of milk is such as to make it a perfect food for infants, and at the same time an ideal culture medium for almost all kinds of bacteria. Sanitarians have in recent years impressed upon the minds of consumers the great dangers arising from the use of unclean and impure milk, and justly so; but in the slow and gradual readjustment of the milk production problem the intrinsic value of milk has often been lost sight of, and in fact prejudice has too often superseded what once was fondness for this product. As numerous publications on this subject, both popular and scientific, are appearing almost constantly, little attention will be given in this paper to the sanitary phase of milk production. It is to be understood, however, that in the discussion of the value of milk as a food pure and wholesome milk alone is given consideration.

There is a widely prevalent notion that the average amount of meat consumption per capita in this country is far beyond what it should be, and there are many who object to meat in any form or amount. These objections are based on the following contentions: first, that the high protein content of meat

subjects the digestive and excretory organs to a heavy burden; second, that as real animal food the consumption of meat necessitates the destruction of the animal itself, and finally that the cost as a rule is out of all proportion to the value received, especially in times of scarcity. It is not within the province of this paper to express a conviction as to whether meat is a necessary or even desirable article of diet. Indeed, the arguments offered both for and against meat and meat products are such as to render a final judgment most difficult.

On the other hand, milk is without doubt the most important of all foods, and must be regarded as an absolute necessity in the early life of all mammalian species, in spite of the fact that here and there proprietary infant foods have been employed with at least some measure of success.

The value of mother's milk to the young infant is too well known to require much comment. However, the growing tendency to substitute artificial for breast feeding is an indication that the subject of infant feeding is not taken as seriously as it deserves. Mother's milk is superior to any and all substitutes, as abundant statistical evidence shows. Furthermore, it has always been the only natural food for the very young.

Next in importance to mother's milk is cow's milk. While the protein content of the latter is much greater than that of mother's milk, methods of modifying it by dilution with water and the addition of milk sugar and cream have in recent years done much to enhance the value of cow's milk in infant feeding, and in fact so successful has this practice become that in the opinion of many physicians and dietitians it is rated as being almost equal in nutritive value to mother's milk.

It is the purpose of this paper to impress upon its readers the importance of milk as a daily article of diet, not only for the very young, but for children of all ages and for adults. If the true value of milk as a stimulator of growth and vigor throughout the developmental period were known and fully appreciated, the number of underdeveloped and anemic children would be greatly reduced. Too often milk feeding for the infant is regarded merely as a necessity, because it is the only food that is tolerated by the easily deranged digestive organs, as experience has long shown. When an age is attained at which other foods are apparently borne as well as milk little effort is made to continue milk feeding, especially if there is any indifference or reluctance on the part of the child.

It is a well-recognized fact that, while the chemical com-

position and physical properties of mother's milk and modified cow's milk are such as to render them an ideal food for young infants, the percentage of solids, particularly sugar, protein and fat, is too small to constitute a complete diet for older children and for adults. Hence, milk must be considered as only a part of a dietary regime after early infancy, except for the sick and convalescent. The amount and kind of other foods required vary with the individual and in a large measure with his or her occupation. For example, a man at hard labor would be required to consume large quantities of milk, in order to obtain sufficient nourishment as compared with a person living a very quiet and sedentary life. However, the benefit derived from the consumption of milk is in all probability not proportionate to the amount of milk taken daily.

One of the greatest modern exponents of the use of milk as a part of the daily diet was Metchnikoff, who by his public utterances and numerous publications stimulated new interest in this subject. Metchnikoff's observations and theories pertained only to so-called "sour milk" and "sour-milk products," and although opinions may differ as to whether or not his explanations of the health-giving properties of sour milk are based upon sound logic, his conclusions must, in a measure at least be accepted. A review of some of Metchnikoff's observations may be of particular interest here. The following excerpts are taken from his most fascinating book, "The Prolongation of Life" (G. P. Putnam's Sons, New York, 1907, translated).

In early biblical times the use of both sweet and sour milk is recorded. From the remotest antiquity a food known as "Leben raib," which is a sour milk prepared from the milk of buffaloes, kine or goats, has been employed in Egypt. A similar preparation known as "yahourt" has long been familiar to the people of the Balkan States. In Algiers the natives use a kind of "Leben" which differs somewhat from the Egyptian product. Soured milk is consumed in great quantities in Russia in two forms, namely "prostokwacha" which is a spontaneously soured and coagulated raw milk, and "varanetz" which is a product obtained by the souring of boiled milk with yeast.

Milk constitutes the chief food for many of the natives of tropical Africa. As in the other countries mentioned, the milk is consumed as a curdled, soured product. Meat is eaten only on rare occasions.

Koumiss is the well-known national beverage of nomadic

tribes in Asiatic Russia. It is prepared from mare's milk, while kephir, which is the native drink of the Caucasus, is the fermented product of cow's milk. Both koumiss and kephir contain, besides acid-producing bacteria, yeasts which cause alcoholic fermentation, the alcohol content of the former being at times as much as one per cent. Matzoon is a milk in which lactic acid fermentation is interrupted at a certain point. It is often tolerated better by irritable stomachs than ordinary milk, koumiss or kephir. It is a highly esteemed and universal beverage of the Armenians, and may be prepared easily by the addition of a small amount of matzoon stock to boiled milk that has been cooled to 100° F.

Coincident with the general use of soured milk in certain countries is the fact that many of the inhabitants live to be very old. This is particularly true in Bulgaria, where yahourth is the staple food. Many of the centenarians live chiefly on the milk diet. For example, Marie Priou, who died at the age of 158 years, is stated to have lived during the last ten years of her life entirely on cheese and goat's milk.

A certain laborer of Verdun in France who died at the age of 111 years ate nothing but unleavened bread and skimmed milk. Another French centenarian who attained 110 years lived on bread and milk food alone. Thense Abalva, a native of the Caucasus, who is at least 150 years old, subsists entirely on barley bread and butter milk. Another apparently well-authenticated example is that of an American eighty-four years old who owes his health to the curdled milk which he has taken for the last 40 years.

While there are comparatively many centenarians on the Balkan Peninsula, in Persia, Arabia, in the Caucasus, and in other countries where sour milk is the chief article of diet, or at least where it is consumed regularly in large quantities, there are relatively few persons who attain this age in the countries where sour milk consumption has not become a national custom.

According to Metchnikoff, sour milk is of great merit because of the lactic acid and of the acid-producing bacteria which it contains in enormous numbers. The ingestion of sour milk has a direct influence on the bacterial processes which take place in the digestive tract, particularly in the large intestine. A diet containing much albuminous food is conducive to marked putrefactive changes in the large intestine. Sour milk or the acid-producing bacteria decrease or prevent this putrefaction, which is the result of ordinary microorganisms that are

normally present in the intestine. In other words, intestinal putrefaction, which is caused by certain so-called "putrefactive" organisms, is a process which is of common occurrence in man, especially on an ordinary mixed diet. This process is in itself harmful on account of the injurious nitrogenous bacterial products that are constantly formed and absorbed from the intestine, this harmful influence being what is commonly called "auto-intoxication."

According to Metchnikoff these putrefactive products, although not strongly toxic in small amounts or when administered for only short periods, work permanent injury to the body when they are being absorbed constantly for months and years. In fact so profound is this baleful influence that it may be considered as one of the important causes of permanent hardening of the arteries, or arteriosclerosis, and indeed premature old age. Acid is one of the agencies which prevents these putrefactive changes in the intestine. It controls the bacterial activities in such a way that only such organisms as are harmless are permitted to increase in appreciable numbers. More recently Metchnikoff has advocated also the use of acid-producing bacteria for the same purpose, claiming that when they are taken into the digestive tract they become acclimated in the intestine and in their continued development suppress the putrefactive bacteria. Many different brands of these acid-producing bacteria are being produced and sold in the form of powders, capsules, etc. The active principle in all of them, however, is the organism known as *Bacillus bulgaricus*, to which in particular most of the sour-milk products of the Balkan and other states owe their peculiar properties.

Bacillus bulgaricus is a unique organism in more respects than one. In a medium containing grape or milk sugar it exerts powerful fermentative properties which results in the production of large amounts of acids, but no gases. Ordinary milk is a particularly favorable medium for this organism, and the acidity produced may reach as high as 2.5 to 3 per cent. This is not at all surprising, as milk contains from four to five per cent. of milk sugar. Very few organisms are able to develop or even live in such an acid medium, and this is especially true of the putrefiers.

Metchnikoff's views have met with no inconsiderable amount of opposition. On the other hand, they have in the main been accepted by many, as is evidenced by the large output of different Bulgaria products sold usually in the concentrated dry form as tablets or powders. These products in many

instances are claimed to possess great remedial properties, as, for instance, in toxic diarrheas, constipation, intestinal putrefaction, arteriosclerosis, and even rheumatism, intestinal tuberculosis and typhoid fever. They have been advocated and used for sprays in diphtheria and other mouth and throat infections. The preparation of sour milk with the aid of these tablets or powders has also become a very common practice in recent years, and there can be no doubt but that in many instances the use of sour milk so prepared has been attended with success.

That the value of these *Bacillus bulgaricus* products has been grossly exaggerated can hardly be questioned, and particularly in so far as the remedial properties of the commercial powders and tablets are concerned. On the other hand, the consumption of sour milk, as advocated by Metchnikoff and his followers, has much to commend it. The value of the sour milk does not lie in the acids or the acid-producing bacteria, however, as will be shown in this paper, but in milk as such, irrespective of the character of the milk as to whether it is sweet, sour, whole, skimmed, raw or pasteurized milk.

In 1892 Rovighi showed that a kephir diet caused a great reduction in the ethereal sulphates (intestinal putrefaction products) in the urine, and of indol in the intestine. He believed that acids played an important rôle in suppressing intestinal putrefaction, but could not substantiate this by practical experiment. In the same year Winternitz demonstrated that milk strongly inhibits putrefaction, and held that this was due to the lactose, and not to the acids resulting from its decomposition by bacteria. The following year Schmits brought about a marked reduction in intestinal putrefaction products by feeding lactose. These observations have been repeatedly verified by other investigators.

The intestinal contents of the new-born infant are free from bacteria and other microscopic organisms. Very soon after birth, however, bacteria make their appearance and in the course of but relatively few hours become very abundant. The nature of these microorganisms is determined by the food of the infant, as was shown by Tissier and others. In the normal breast-fed child an organism first observed and described by this writer, and known as *Bacillus bifidus*, is present to the exclusion of all other forms. This organism readily attacks milk sugar without gas production, but has no putrefactive properties; in other words, it does not decompose albuminous substances with the formation of injurious products.

A change from breast- to bottle-feeding is accompanied by a change in the character of the intestinal flora. The simplified type is transformed into a mixed flora in which another organism, *Bacillus acidophilus* of Moro, assumes much prominence. When the diet becomes more varied by the addition of other foods, as, for example, egg and bread, the intestinal flora becomes still more complex and gradually assumes the character of that of the adult.

The bacterial flora of the intestine of man and animal may in a very large measure be determined by the diet. We have repeatedly shown that the bacterial contents of the intestine of the white rat may be transformed from the mixed to a simplified flora by the addition of milk to the regular diet. In the course of one to three days a flora is established which resembles that of an infant subsisting entirely on milk. When milk sugar is fed along with the milk, or alone in sufficient amount, the typical *bifidus* flora of the breast-fed child is obtained. The same transformation may be brought in the intestine of man, though relatively larger amounts of milk and of milk sugar are required. Torrey demonstrated that the feeding of a high caloric diet (milk and milk sugar) to typhoid patients tended to reduce the putrefying types of bacteria and to encourage the so-called "acidophilic" organisms which characterize the intestinal flora of infants subsisting entirely on milk.

The favorable influence of milk on the bacteria of the intestine is due largely to the lactose or milk sugar in the milk, which at times contains as much as six per cent. of the carbohydrate. The harmless and perhaps even beneficial bacteria of the *Bacillus bifidus* type readily attack milk sugar, and in the presence of this sugar find their optimum environment in the intestine, and develop so readily as to suppress or crowd out the harmful or putrefactive forms which find their most favorable cultural conditions in a medium rich in nitrogenous matter and poor in carbohydrate.

The preponderance of the sugar-loving type is not due to the acids that are produced in the decomposition of the sugars, nor can the reduction or disappearance of the putrefactive forms be ascribed to the presence of free acids in the intestine, for, except when they are introduced into the intestine in large amounts, acids rapidly disappear through absorption by the intestinal wall or by neutralization. This has been shown repeatedly. Metchnikoff's contention that the use of sour milk and milk-souring bacteria is of benefit to the consumer because of the action of the acids that are thereby introduced into the

intestine is not supported by direct observation. The suppression of putrefactive processes is brought about by influences other than acids.

It has likewise been shown again and again that the ingestion of even very large numbers of *Bacillus bulgaricus* with or without milk does not lead to an implantation and acclimatization of this organism in the intestine. This bacterium, which is of such wide distribution in nature, and especially in different kinds of sour milk, is unable under any and all conditions to establish itself in the intestine of man or animal. However, an organism (*Bacillus acidophilus*) which in many respects is closely allied to *Bacillus bulgaricus* is a common inhabitant of the intestine. Like *Bacillus bifidus*, which it closely resembles in appearance and physiological properties, *Bacillus acidophilus* is comparatively rare in the intestine during an ordinary mixed diet or one rich in protein. The addition of milk or of milk sugar to the diet encourages the development of this organism in the intestine, and at times to such an extent that all other forms are apparently excluded. This bacterium has often been mistaken for *Bacillus bulgaricus*.

That the so-called *Bacillus acidophilus* is not the same as the other may be shown readily by feeding milk which has been sterilized. The same transformation takes place in the intestine as when unheated sour milk is consumed. The ingestion of milk in any form, sweet, sour, raw or sterilized, leads to this same result. On the other hand, the feeding of even very large numbers of *Bacillus bulgaricus* in water, without milk or lactose, does not result in the implantation of the ingested organism, and the intestinal flora remains unchanged. It may be said, therefore, that diet is an important factor in determining the character of the intestinal flora, and that foreign bacteria find it difficult and as a rule impossible to establish themselves in the intestine. Bacteria which are of the strictly disease-producing type are, of course, not to be included in this category.

Aside from the significant fact that milk when taken in sufficient amount regulates the biochemical changes which take place in the lumen of the intestine, milk as such constitutes a most important article of diet. The value of milk as a food lies not only in its peculiar composition, that is in the proteins, fat, sugar, inorganic salts and other well-known ingredients, but also in certain demonstrable but as yet vaguely-defined substances known as "vitamins" or "accessories." These vitamins belong to a group of agents which are widely distributed

in nature, and which are now regarded as an essential factor in diet. Let us next consider some of the evidence which supports the assertion that milk possesses unique dietary properties.

Hopkins clearly demonstrated that the feeding of very small quantities of milk to rats which had been subsisting on a diet that was not conducive to normal growth brought about a rapid gain in the weight of the animals. Osborne and Mendel in their valuable experiments on the growth of animals have for several years been employing so-called "protein-free milk" as an indispensable ingredient of their basic diet to which certain isolated food substances (proteins, amino acids, etc.) are added. They state that "no artificial imitation of this natural mixture (milk from which all protein had been removed) has been devised to replace it satisfactorily for considerable periods of time." The weight and health of adult rats has been maintained for many months on a ration consisting of protein, starch, sugar, protein-free milk and lard. Young animals kept on this mixture decline after a definite period. If butter fat is substituted for the lard, however, growth is resumed. Hence, they consider the fat as one of the important food substances in milk. The fat is in all probability of much importance on account of the vitamins which it holds, and which are fat-soluble, as contrasted with the water-soluble accessories present in the protein-free milk. Ordinary skim milk contains both the fat-soluble and water-soluble accessories.

Numerous milk-feeding experiments have been conducted on young animals of different species, but few have been of much scientific value, owing to incomplete data and to a lack of adequate control of the experiments. The following investigation is one in which the writer was for several years engaged, and in which the results were a source of surprise even to those who were most intimately associated with the experiments.

THE INFLUENCE OF MILK ON GROWTH AND MORTALITY

Numerous experiments were conducted on young chicks. When one to two days old the chicks were taken from the incubators, divided into uniform groups, usually six, each group containing from 25 to 60 chicks. Half of the lots, for example 1, 3 and 5, were supplied with milk in a shallow galvanized stew pan covered with a meshed wire, while the remaining lots, 2, 4 and 6, received no milk. Both the general groups of

chicks were constantly provisioned with a standard chick feed and dry mash. The milk was kept before the milk-fed chicks constantly. It was supplied as a rule as skimmed milk, rarely as whole. In some of the experiments sweet milk was employed, in others naturally soured, and in still others milk which had been soured by the *Bulgaricus bacillus* of Metchnikoff. In the preparation of the *Bulgaricus* product the milk was sterilized by live steam under pressure. Hence, both raw and sterilized milk was used in large amounts. Over five thousand chicks were employed in this investigation. The duration of the individual experiments was six to eight weeks.

In all of the experiments the milk-fed chicks were larger and in every respect appeared stronger and more vigorous than the corresponding control lots which received no milk. In a few instances the difference in the average weight of the two lots was almost 100 per cent. Furthermore, the combs of the milk-fed groups were redder, and the legs decidedly stronger, than those of the other lots. In one particular experiment, which was allowed to continue longer than the others, a marked difference was noted in the ages at which the males exhibited crowing propensities.

TABLE SHOWING THE INFLUENCE OF SOUR MILK FEEDING ON GROWTH
(Combined results with 1,498 chicks)

Number of Chicks	Gains per Chick at Completion of Experiments		
	Fed Sour Milk	No Milk	Difference
(1) 890.....	0.7 pound	0.43 pound	0.37 pound or 38.5 per cent.
(2) 608.....	0.79 "	0.46 "	0.33 " " 41.8 " "

That the growth-stimulating properties of milk are not confined to sour milk is clearly shown in the following summary of results on 375 chicks:

Combined averages:

	Gains per chick
Fed sour milk	0.48 pound per chick
Fed sweet milk	0.44 pound per chick
Given no milk	0.39 pound per chick

The results obtained with naturally soured and with *Bulgaricus* milk were practically the same, hence no definite figures are presented here. It should be said, however, that a slight preference was shown for the naturally soured milk, as compared with the sweet and with the *Bulgaricus* product.

In the chick-feeding experiments milk exerted a pronounced influence on mortality, no matter whether sweet, naturally soured or *Bulgaricus* milk was supplied. The following figures give the combined results obtained in eight different experiments with 1,125 chicks.

TABULATED RESULTS SHOWING THE INFLUENCE OF SOUR AND OF SWEET MILK ON MORTALITY

Sour Milk		Sweet Milk		Without Milk	
Number of Chicks	Deaths	Number of Chicks	Deaths	Number of Chicks	Deaths
375	65, or 17.3%	375.....	61, or 16.3%	375.....	114, or 30.4%

In two experiments not included in the above figures there was no mortality among the milk-fed chicks, while the loss in the control pens receiving no milk was 10 and 12 per cent.

The favorable influence of milk here shown can not be attributed merely to a regulation of the character of the intestinal flora, but is to be explained in a large measure on the basis of health and vigor production through the growth-producing and stimulating properties of the milk. Growth is a normal process in which metabolic activities are at their height and in which the body cells and tissues are printed to meet the requirements placed upon them. Resistance to inimical influences is stimulated and health is conserved.

Milk contains two important nitrogenous food substances, namely, casein and lactalbumin. Of these two proteins the lactalbumin is the more important in supplying the necessary material for growth and body maintenance, according to the researches of Osborne and Mendel. This is due to the fact that it contains certain chemical groups (amino acids of peculiar composition, as for example lysin) within its molecule which are not present in the casein. Whatever deficiency there is in these substances is more than counterbalanced, however, by the amount of casein present in milk (3 per cent.) as compared with the lactalbumin (0.5 per cent.). Osborne and Mendel found in their feeding experiments with white rats that to produce the same gain in body weight 50 per cent. more casein than lactalbumin was required.

The milk sugar (5 per cent.) and fat (3.5-5 per cent.) present in cow's milk also add greatly to the fuel value; furthermore, the various inorganic substances, particularly calcium, sodium and potassium salts, and the phosphates can not

be ignored. While all of these valuable constituents contribute their great share in making milk the most important of all foods, we must seek further for a full explanation of its real merits. We turn naturally to the so-called "vitamins," to which reference has already been made.

There are present in milk "vitamins" or "food accessories" of two orders. The one is fat-soluble and is therefore bound up in the butter fat. This agent is closely akin to the vitamin of egg yolk and of cod-liver oil. The other is water-soluble, and is present in milk from which the fat has been to a large extent or entirely removed. While opinion has differed as to the heat tolerance of these accessories, there is no doubt that both the fat- and the water-soluble vitamins withstand the heat of ordinary pasteurization, and that they are not completely destroyed even in the process of boiling for as short a period as 10 to 15 minutes. These facts are of much significance, since they have a direct bearing on the question of the relative food value of raw and pasteurized milk. Food accessories or vitamins are now regarded as being absolutely necessary in an efficient diet. Nutritional diseases like scurvy and beri-beri are known to be due to the continued and exclusive use of a diet, as, for example, canned foods and polished rice, from which the vitamins have been lost by excessive heating or the removal of certain parts of the food, as in the polishing of rice.

Considerable effort has been made in recent years to overcome the prejudice existing in the minds of most Americans against pasteurized or boiled milk. No one has done more to convince physicians and laymen that heating does not alter the food value of milk, and that it even improves the quality of milk which is not of a high standard from the standpoint of real sanitation, than Janet E. Lane-Claypon, who has devoted years to this problem. This author's recent book on "Milk and its Hygienic Relations" (Longmans, Green and Co., New York) presents an excellent résumé of the subject of milk in its various phases, and particularly the relative merits of heated and unheated milk. While milk in its relation to infant feeding is the underlying theme throughout the book, the data and discussions on the influence of heat may be applied as well in any movement to stimulate a more general use of milk in its various forms and for persons of all ages.

The time has come when raw milk from tuberculous cows must be regarded as a useless commodity. Such milk is used, however, by thousands of consumers daily, for a large amount of market milk to-day may be found by correct methods to con-

tain the bacillus of tuberculosis. The only real safeguard against possible danger from infected milk is proper heating.

Bang of Copenhagen has adopted and successfully carried out a system of rearing calves which come from tuberculous mothers on milk which has been boiled. The calves are taken away from the mother very soon after birth, and brought up on the heated milk on so-called "calf farms." These calves remain free from tuberculosis, and hence become a valuable addition to the newly selected adult herd, which should remain tubercle-bacillus-free. Similar methods have been followed in this and other countries, not only for the purpose of eliminating tuberculosis from a herd, but also to protect the calves against diseases like "scours" and contagious abortion. Professor V. A. Moore has strongly advocated the feeding of boiled milk to calves, though in one paper he states that a preliminary feeding with raw milk may be advisable.

The following facts are, to a large extent, taken from Miss Lane-Claypon's book: Finkelstein in a large number of observations on children having digestive disturbances concludes that "no definite distinction between the results obtained by feeding upon raw and boiled milk respectively could be detected." "Plantenga treated children with digestive troubles with both raw and boiled milk, and was unable to find any evidence of the superiority of either method of feeding."

In the important investigation of Park and Holt the results were much more favorable from the standpoint of the pasteurized than the raw milk. "Of 51 children who were fed on raw milk, 13 had to be transferred before the end of the period of observation to pasteurized." "Hohlfield published 8 cases of children suffering from various stages of malnutrition who were fed for the most part upon raw milk; some, however, received raw milk alternately with boiled milk." Numerous additional cases might be cited here in which heated milk possessed the same nutritional properties as the raw. It should be stated that the results which favor the heated milk may have been due to a slight extent at least to the bacteria and their products which were present and continued to be harmful in the raw milk.

Pasteurization of cow's milk is rapidly assuming more and more importance in this country. This is due largely to the growing recognition of the possible dangers which may lurk in milk which has not been produced and handled under the most sanitary conditions. It may be explained also on the ground that commercial pasteurizers are becoming more effi-

cient and reliable. Of these pasteurizers two stand out conspicuously as having special merit, the so-called "holding device" in which the milk is held for 20 to 30 minutes at 145 to 150° F., and the device by which the milk is heated at the pasteurization temperature in the package or bottle in which it is delivered. The last-named method has the distinct advantage that the milk can not become re-contaminated after the heating, except by the consumer himself. Pasteurization by this method is one of the best safeguards against milk-borne tuberculosis, typhoid fever, dysentery, septic sore throat and diphtheria. While certified and other high grades of milk are much less apt to contain disease microorganisms than the ordinary market milk, they can not be considered absolutely safe simply because they were produced under sanitary conditions, for there is always a chance of infection from an unrecognized tuberculous cow or from a human carrier.

The use of milk as a daily article of diet can not be too strongly advocated. It matters little whether it is whole, skim, pasteurized or raw, aside from the element of possible danger from harmful bacteria. Nor can too much be said of the nutritional value of cheeses which, we are told, are among the most valuable of our concentrated foods, and which, contrary to popular opinion, are well borne by the digestive and related organs, provided they are well masticated or prepared in a finely divided state before they are served as food.

Skim milk has always been regarded in this country as an almost useless commodity, and many thousands of gallons have been poured daily into the drainpipe. Quite recently, however, the feeding of skim milk to farm animals, particularly young swine and poultry, has fortunately become a general practise. But as food for man it has been not merely ignored, but shunned. This is made all the more apparent by the legal regulations which, because they require the conspicuous labelling of skim milk that is offered for sale, have tended to discourage the sale of this product. Skim milk contains almost the same amount of nutriment and so-called "accessories" as whole milk, the only difference being in the quantity of fat which by the skimming is reduced three to four per cent. All of the sugar, casein and lactalbumin, as well as the significant vitamins, inorganic salts and a small amount of fat are retained in the product commonly termed skim milk.

Skim milk should find its way into every home, at least for cooking purposes, and its use in cooking and baking should be made a very common practise. The present-day agitation to

bring about a more general employment of skim milk in the home should receive universal approbation, from the standpoint of both health and economy.

Many persons have little or no tolerance for sweet milk, while sour or buttermilk is well borne. For such individuals the sour milk obtained by the use of *Bulgaricus bacillus* tablets or powders will often be found to be a good substitute for sweet milk. These bacillus tablets or powders may be purchased at any reputable drug store, being prepared by a number of large manufacturing houses in this country. Skim milk or milk from which part of the cream has been removed is heated until it boils. It is then allowed to cool to about 105° F., and inoculated with a sufficient amount of the *Bulgaricus* preparation (two or three ordinary tablets for each quart of milk). The tablets or powders should be mashed and mixed with a small portion of the milk before all of the latter is treated. After thorough agitation the milk is kept in a moderately warm place (on the back of the range or in a special incubator or fireless cooker). Four to five hours at 105° F. are usually sufficient for the necessary souring, and great care should be taken to prevent the milk from becoming too acid. When the incubation is completed the product should be placed in the refrigerator and constantly kept at a low temperature, to preserve the correct flavor. For preparing a new product from day to day some of the preceding fermented milk may be used instead of the commercial preparation.

A dish that is highly relished in parts of Europe is a bowl or crock of naturally soured milk from which the cream has been removed and over the surface of which broken bits of bread or toast are distributed so as to form a complete layer. This layer is usually sweetened with table sugar, and in many instances cinnamon and other spices are employed to heighten the flavor. *Bulgaricus*-soured milk is also put to a similar use by many thousands of persons who subsist in a large measure on a milk and bread diet.

In concluding this paper the writer wishes again to emphasize the nutritional value of milk as milk, irrespective of whether it is whole, skim, sweet or sour milk. On account of the highly important known food substances which are present, namely fat, sugar, casein, lactalbumin and certain inorganic salts, and of the as yet poorly understood vitamins or accessories, milk has a most stimulating influence on bodily growth and strength, and therefore is an important factor in regulating and preserving health.

Pasteurizing or boiling for a short period does not destroy the nutritional value, as numerous experiments have without doubt demonstrated, although physicians have from time to time claimed that heated milk as a diet for small children is conducive to scurvy. Where any doubt concerning this point has existed the feeding of small amounts of orange juice has been sufficient to allay fear.

Sour milk is not beneficial on account of the acid or acid-producing bacteria which it contains, but, like sweet milk, tends to encourage the development of an intestinal flora from which the putrefying bacteria are greatly reduced or absent. This property milk seems to owe to the sugar which it contains. Skim milk exerts the same influence.

FOREST GROWTH ON ABANDONED AGRICULTURAL LAND

By P. L. BUTTRICK

NEW HAVEN, CONN.

ALTHOUGH the process of clearing forested land for agricultural uses continues in nearly all sections of our country, another, generally less conspicuous, but almost as important, process occurs along with it—the abandonment of cultivated land and its reversion to forest. This reversion to forest, or “afforestation” as it is called, is of great interest both to the forester and to the agriculturalist. To the former because it helps to replenish the waning timber supply, and to the latter because it provides a means of utilizing lands no longer used for raising crops and grazing.

Reasons for Abandonment of Agricultural Lands.—This abandonment of agricultural lands takes place in all sections, but chiefly in relatively remote although long-settled regions, such as some parts of rural New England. There are several reasons for its abandonment, such as: (1) loss of fertility, an example of which is the abandonment of many acres in parts of New England; (2) change of economic conditions rendering further cultivation unprofitable. The classic example of this is the large cotton acreage in Virginia and the Carolinas abandoned during the Civil War. (3) Discovery that certain lands are not suited for agriculture, at least as it has been practised in the locality. Examples of this are to be found in every region which has been settled for any length of time, where isolated fields in swampy sites, or hilltops, and the like, have been neglected when it has become evident that their cultivation was not profitable. General shifts in rural population from long-settled regions in the east to the west, and to the urban districts, have frequently caused land to be abandoned that was actually good farm land, but on the whole most of the abandoned lands have been of inferior quality.

Favorable Conditions for Tree Growth Found on Abandoned Lands.—Generally speaking, conditions are very favorable for tree growth on abandoned lands. The soil, although possibly worn out from an agricultural point of view, has been refreshed during its period of cultivation in those constituents

which make it desirable for tree growth. It is well broken so that the seed can easily reach the soil itself (often a difficult thing in the natural forest) and the roots of the seedlings can easily penetrate it. Seedlings do not have to compete with the older trees for light, moisture and growing space. If the field happens to be turfed over, once the seedlings have become established, the competition of the turf is of no great moment, although it may delay the seeding up of the field considerably in the first place. Because of the lack of inflammable litter on the ground, fire seldom interferes with old field stands, as stands growing upon abandoned lands are commonly called, during their period of establishment. This fact gives such stands a great advantage over stands coming in on cut-over lands, which must frequently cope with severe fires in the slash formed by the old cuttings. The fire hazard may, however, be quite high for old field stands during the middle period of their development, because of their frequent crowding and high density.

These conditions do not favor all trees, as there are certain species which do much better to start with under the shade of other trees, and do not take kindly to the exposed conditions of open fields, but this fact has little bearing on the situation, since it merely rules those particular species out of the race for the capture of clearings. Every humid region seems to have a sufficiency of trees capable of becoming established and growing well under open field conditions.

Influence of Other Vegetation.—Abandoned agricultural lands fall into two classes: (1) Fields not covered with turf, (2) pastures. It frequently happens that when it develops that a field is no longer valuable for crops it is seeded down as a pasture and grazed for a period before its final abandonment. This delays materially the return of the forest, but it comes back in time, nevertheless. In sections where soil erosion is common and turf does not grow especially well, such as is the case in portions of the south, its entire absence may allow such action to get the upper hand and wash away rapidly the seeds and seedlings, so that final recapture is greatly retarded or altogether prevented for long periods. Sometimes, because of close proximity of seed plants or other causes, an abandoned field is quickly seeded up by worthless brush before tree seed has a chance to reach it. This may delay but does not prevent the return of forest conditions. It seems that throughout most of the eastern portion of the United States the forest rather than the grass or brush type of vegetation is the ultimate type,

and toward it all types evolve. It is entirely probable that if all the land in the eastern United States were abandoned it would eventually be clothed in forests similar to those found here when the white man came.

Types of Natural Reforestation on Abandoned Lands.—

There are two types of recapture—immediate and gradual. In the first case, almost immediately a field is abandoned a young homogeneous even-aged stand springs up over the entire area. In the second the recapture is slow and may extend over many years, the resulting stand being all-aged, in which case some of the seed which goes toward stocking the area is often produced by the earlier arrivals, so that the trees do not all belong to the same generation. On very large clearings the second type must perforce prevail, since seed can not be sown naturally over sufficient area to yield at once a full stand. It sometimes happens that several bands of growth of different ages occur on a field, that farthest from its edge being the youngest. The forester describes such a stand as “even-aged in groups.” On average-sized clearings it is generally the case that fields abandoned directly from the plow are reclaimed practically at once and support therefore even-aged stands; while pastures owing to the competition of the turf are more apt to be recaptured slowly, particularly if grazing takes place upon them, and in consequence their stands are uneven aged.

Transportation of Seed.—The recapture of abandoned fields depends primarily upon the ability of tree seed to reach them in sufficient abundance. The several agencies which aid in its transportation are: (1) wind, (2) birds and animals, (3) gravity, (4) water. Wind is the most important, it being the only one capable of disturbing seed abundantly over large areas. Its action, however, is limited to seeds of light weight with some sort of a winged attachment by which it can grip them. Wind-disseminated seeds are of three classes: (1) Very light thistledown-like seeds such as those of willows and poplars, which will float on light airs and travel for many miles; (2) medium-light seeds such as those of the birches, which can be blown for long distances, but will not float on light airs; and (3) medium-heavy, generally winged, seeds, such as those of the pines, ashes, maples, tulip poplar¹ and many others, which will flutter to the ground except in the face of a considerable breeze, and even then are not apt to travel more than

¹ *Liriodendron tulipifera*. With a few exceptions scientific names of trees have been omitted, since common names are so well standardized as to make it unnecessary.

a few hundred yards in sufficient abundance to form a stand. Birds and animals generally limit their activities to the transportation of such seeds (or fruits) as are in whole or part edible (from their points of view). The fruits of the common red cedar and the black cherry are examples. The fruit is eaten by birds and the indigestible seed is deposited wherever they happen to fly. Animals such as squirrels and other rodents generally operate by taking nuts, acorns, etc., from the seed trees or the ground beneath them into the open and burying them for food stores. It is possible that certain birds, for instance the blue jay, also do this. Gravity plays its distinctive part only on sites where heavy seed roll down-hill. Water plays its part in washing seeds down-hill and covering them with earth once they have reached their resting places. The flooding of bottomlands by overflow from streams does not seem ever to leave a sufficient deposit of seed to make any impression after the water has subsided.

Trees which Succeed in the Capture of Abandoned Fields.—As has already been intimated, a species to succeed in the capture of open fields must have several characteristics, the chief of which is that it must have seed which may easily be transplanted by natural agencies, and is produced regularly and in abundance. After that it is necessary that the species be able to start in the open, and, if necessary, to compete with grassy or brushy vegetation, and to get along with comparatively little moisture. Swamp-loving species seldom succeed well on abandoned fields. The most successful old field species are also rapid growing so that they are able to forge ahead of the brush and worthless growth which often crowds in with or ahead of them. Successful slow-growing species, such as the red spruce and the red cedar, are either very tolerant, so that they are not affected by the light competition, or are early comers and succeed by being the first on the ground. A tree must also be able to grow in closed stands, which some light-seeded species like the ashes are unable to do. On pastures or in sections where stock is allowed to range species which for some reason are objectionable as food plants for the stock have an advantage, since they are less liable to be eaten off or broken down. The tulip poplar seems to be liked by cattle and is in consequence badly damaged where grazing is allowed, while thorny trees like the black locust are almost immune from their attacks, and conifers suffer far less in this way than broad-leaved species.

Difference between Old Field and Natural Forest Types.—

As a result of the requirements necessary for the success of a species in recapturing abandoned fields, it frequently happens that the stands which grow under such conditions differ radically in composition, form, rate of growth and final yield from those of the surrounding natural forest. To the non-professional eye the most striking difference is apt to be in the species. Old field trees are in many cases trees which are of subordinate importance in the original forest. In southern New England gray birch and red cedar—the leading old field species of the region—are of rare occurrence in the long-established woodland. In portions of Pennsylvania and New Jersey the scrub oak which frequently takes possession of the old fields seldom rises to the dignity of a tree in the original forest. Further south loblolly pine, a tree of naturally limited distribution in the long-leaf pine region, seeds in abundantly on abandoned fields in that section, to the almost entire exclusion of the long-leaf itself. On the other hand, there are cases where the most important tree in the forest is also the most important old field tree. Old clearings in northern New England frequently seed up to rather dense stands of red spruce, that being the dominant tree in the original forest.

Notwithstanding the occasional similarity of species, the form of the forest is generally quite distinct on old fields from that in the original forest. Virgin forests in most cases tend toward an all-aged form. While we have seen that old fields may be either many-aged or even-aged, they generally approximate the latter. In many long-settled portions of our country the original forest has long since entirely vanished, and the form which has succeeded it differs more or less from it. In southern New England a sprout forest is now the dominant form. The forest which takes possession of the abandoned fields is of necessity of seedling origin, and therefore different fundamentally from the existing form. We might go on naming ways in which old field stands differ from the original or prevailing ones. Yet from the practical viewpoint the most important feature is their rapid growth; not only individual trees, but entire stands make more rapid growth in height and volume than takes place in the natural forest. It takes from 75 to 200 years for red spruce grown in the virgin forest to become merchantable, but old field stands of the same species are frequently merchantable at 60 years. The same acceleration of growth is observable in all old field stands. However, the timber cut from such stands is seldom as high grade as that from the original forest.

Reversion of Old Field Types to Those of the Original Forest.—In every forest region there are two classes of forest types—permanent and temporary. A permanent type is one naturally adapted to the growing site and capable of maintaining itself indefinitely without change of form, and toward which all other types occupying similar sites evolve. It represents a state of equilibrium. If a permanent type is destroyed by fire, clearing or other cause, it is generally succeeded by a forest type of a different sort, but which gradually undergoes a transformation and finally can not be distinguished from the original. Such a type is known as a temporary forest type. Old field types belong to this class. The open-field conditions which favored the establishment of certain species gradually disappear as the area becomes more and more wooded, the crop of light-seeded, quick-growing trees which crowd in at first do not always find the site favorable when forest conditions are fully reestablished. When this has largely or completely taken place the less adaptable species begin to creep in—those which can not start perhaps without some sort of protection, or the heavy-seeded species, the slow-growing ones and the like. After a sufficient time they come up through the first arrivals and partly or completely crowd them out. In northern New England hardwoods, such as birch, beech and maple, creep in among the spruces, till finally about the same proportion of hard and soft woods is obtained as is found in the original forest. In southern New England the oaks and chestnut creep in underneath the gray birch and red cedar and, after the latter have reached their normal height growth, grow up through them and shade them in. Thus the prevailing mixed hardwood type succeeds to the old field type. It is thought to require almost a century from the time the field is first abandoned till it finally passes over completely to the mixed hardwood type. Similarly in parts of New Jersey and Pennsylvania the scrub-oak type changes to one of mixed hardwoods and pine. In the south the reversion of the loblolly to the long-leaf type has not been observed, but, under natural conditions, would be expected to occur in time. It has probably been prevented because lumbering and forest fires have so far swept away the long-leaf that there are not enough trees left to act as seed trees.

Commercial Value of Old Field Stands.—From the practical viewpoint of the forester and the lumberman, old field stands are generally regarded as of much or little value according to their yields of commercial timber. They have little respect for

such types as the scrub oak in Pennsylvania and New Jersey and the cedar and gray birch in southern New England. In the former case the type is an unmitigated nuisance and is of no value whatsoever. If it could be kept out, a stand of valuable trees might be secured many years sooner. The cedar and birch type is of little value save what the birch has for cordwood and the cedar for posts. While red cedar makes excellent fence posts and has other uses, its very slow growth renders it unprofitable to encourage it. On the other hand, old field stands of red spruce, white pine, loblolly and short-leaf pine frequently have a high market value.



OLD FIELD STAND OF RED CEDAR IN SOUTHERN CONNECTICUT. Age 1-20 years.
One half stocked. Seeding up still in progress.

Aside from the species, much depends upon the form and density of the stands as to their value. Stands which do not seed up thickly enough have few trees and those few of poor form, being short and limby, producing poor knotty lumber. Stands which are too thick produce long slim poles, too small in proportion to their height to make good saw-logs. Sometimes this overstocking is so great that the trees crowd each other so severely that growth almost ceases. The forester is more and more being called upon to remedy one or the other of these conditions. In the first case he recommends the planting up of the vacant spaces with trees of desirable species so as to bring the stand up to full density; in the second, the cutting of enough of the inferior trees to allow proper growing space for the others.

Important Old Field Types.—In conclusion it may be worth while to discuss briefly a few of the more important old field types found in the eastern portions of the country. Starting in the northeastern part of the United States, they are: (1) *red spruce*, (2) *white pine*, (3) *red cedar* and *gray birch*, (4) *scrub oak*, (5) *loblolly pine*, (6) *short-leaf pine*, (7) *tulip poplar* and *other hardwoods*. Some of these types also occur on cut-over lands, but generally the two classes of sites, even when occurring side by side, exhibit sufficiently different conditions to cause pronounced differences in their forest growth, and the problems of obtaining satisfactory forest regeneration on the two are generally distinct.



Photo by Prof. J. W. Tooney.

STAND OF OLD FIELD WHITE PINE IN NORTHERN CONNECTICUT. Age 30-35 years.
Trees 16 inches in diameter. 70-80 feet high.

1. *The Old Field Spruce Type.*—On hilltops in Vermont, New Hampshire, Maine and northern New York there are many abandoned fields, most of them left vacant when the owners sought more fertile lands in the west. These have been and still are seeding up to a variety of types, but the most characteristic and valuable is the old field spruce type. It is often mixed with a considerable percentage of balsam. These lands in most cases have a commercial value soon after their establishment, since it is from them that the supply of Christmas trees sold in the northeastern United States is so largely derived. At from fifty to sixty years of age they are large enough to be cut for pulp-

wood and a few years later for lumber. As yet, except for the Christmas-tree yield, this type has no great commercial value since few stands have been long enough established. Its potential value, however, is very great. Frequently these stands are so thickly stocked that a thinning is advisable at from twenty-five to thirty years.

2. *Old Field White Pine Type*.—In southwestern Maine, southeastern New Hampshire, portions of Massachusetts, Rhode Island and northern Connecticut the original forest was largely composed of white pine mixed with a small percentage of hardwoods, although since early times the amount of pine has very greatly diminished. Abandoned fields, however, generally seed up rapidly to comparatively even-aged stands of white pine, although sometimes the pitch pine wholly or partly takes its place. At forty years of age these stands, if their density is full, may yield as high as twenty thousand board feet of lumber to the acre. To-day many such stands are being harvested—the wood being used chiefly in the manufacture of box boards. It is by means of these stands that Massachusetts has been able to maintain her place as one of the leading white-pine producing states.

3. *Red Cedar and Gray Birch Type*.—This type is common in Connecticut, southern New York and portions of northern New Jersey. It is really a combination of two types. The red-cedar type, which comes up very scatteringly over abandoned pastures, and is many years in entirely reclaiming them; and the gray birch type, which often comes up very thickly in a few years after a piece of land is abandoned directly from the plow.



OLD FIELD STAND OF SHORTLEAF PINE IN NORTH CAROLINA. Trees 10 to 20 years old. 20 to 30 feet tall.



STAND OF TULY'S POPLAR SEEDLING IN ON AN ABANDONED FIELD IN THE MOUNTAINS OF EASTERN KENTUCKY. Age 10-20 years. Density full.

These two types are so frequently found mixed in all gradations that they are commonly, as we have seen, treated as one. Its chief value is that it frequently captures a field before it is overrun with a tangle of briars, sumac, sweet fern and other equally worthless plants. It is likewise exceedingly difficult for the forester to handle this type so as to make it yield commercial timber at a reasonable age. One recommendation is to cut it clear and replant it to white pine or some other valuable tree. This is of course expensive, even though as an investment it may yield a good return when the plantation comes to maturity. In addition the owner generally hesitates to sacrifice an already established stand even though its final commercial value is sure to be low. Another plan is to plant up the numerous blanks which generally occur and gradually to thin out the naturally established trees in favor of the more valuable planted ones, meanwhile thinning the spots where the natural stand is too thick, so as to encourage the most desirable of the cedars, and such valuable hardwoods as have become established.

4. *The Scrub-oak Type*.—In parts of Pennsylvania and New Jersey and to a lesser degree in other portions of the eastern United States, a type of non-commercial oak springs up rapidly on abandoned fields. It is hardly worthy of the name of a forest, since it grows to a height of only six or eight feet and forms an almost impenetrable thicket, valueless from every point of view. The acorns of these scrubby oaks, chiefly *Quercus mana* and *prinoides*, are very small and are presumably

carried to the fields by birds and animals. Their habit of growth, which is spreading, causes them to take up more room than trees many times their height. In the course of time moderately tolerant and valuable conifers such as the white pine and hemlock and hardwoods such as various of the standard oaks seed in under this mass of brush and grow up through it. The scrub oak itself is quite intolerant and as the other trees grow above it it is shaded out and disappears. The process of overcoming this pernicious old field type delays the recapture by valuable species from fifty to seventy-five years.

The practise of forestry to aid nature in growing a timber-producing forest on such sites is to plant a desirable species before the scrub oak has gotten possession of the site, or to cut it off and plant it if the oak has already come in. Under planting with tolerant species might succeed, especially if clearings were made about each individual tree as it was planted. Desirable natural growth could also be encouraged by cutting the oak away from it.

5. *Old Field Loblolly Pine Type*.—The stands of loblolly pine occurring near the coast from Maryland southward are the most important commercially of any old field stands in the country. Most of them had their origin on cotton fields abandoned during the Civil War. They become merchantable in about forty years, at which time they contain an average of from two hundred and fifty to three hundred trees to the acre, averaging about ten inches in diameter and sixty feet high. The yields average perhaps eight thousand board feet to the acre. The forester can frequently assist in increasing these yields by judicious thinnings in young and middle-aged stands. The timber from this type has already to some extent taken the place of that formerly cut in the same region from the virgin long-leaf stands, which are now all but exhausted.

6. *Old Field Short-leaf Pine Type*.—The original forest of the Piedmont Plateau section of the southern states is a mixture of short-leaf pine and various hardwoods, chiefly oaks. On old fields the pine is apt to seed in rapidly to the exclusion of the hardwoods. Since relatively little land in this section has been abandoned, the commercial value of this type is not yet great. However, short-leaf is a valuable wood and the stands seem to grow rapidly so that they will some time be quite valuable, although it is not likely that sufficient land will ever revert to forest to make them an important source of timber.

7. *Old Field Tulip Poplar Type*.—Abandoned fields in the southern Appalachian Mountains frequently seed up to tulip

poplar—the yellow poplar of the lumbermen and the tulip tree of the botanist—and various other less important broad-leaved trees. Yellow poplar is a highly valuable wood of which the supply is not too great. Since the tree seems to grow with great rapidity on these abandoned fields, such stands are of high potential value, although as yet few of them have reached commercial size. The amount of land abandoned does not give promise of ever being great enough to make such stands an important source of timber.

There are, of course, other old field types, as well as great variations in the ones here described, but those mentioned are the most typical and important, and as time goes on their importance will not be lessened.

Until the final balance is struck between agricultural and forest land in this country—something that seems a long way off—there will always be a certain amount of land passing from one state to the other, and with the growing scarcity of timber the attention of foresters and lumbermen will be increasingly interested in the stands produced on abandoned lands. The forester will be interested in seeing that the proper species are reproduced on them and that they are managed so as to secure full stocking and maximum yield. He will more and more anticipate nature by planting the land to trees as soon as it ceases to be cultivated. The lumberman will turn more and more to those stands for his supply of raw material as the virgin and long-established forests are exhausted.

THE PROGRESS OF SCIENCE

SIR HENRY ROSCOE

THE recent appearance of a biographical sketch of Sir Henry Roscoe, by his former student and friend, Sir Edward Thorpe, has added much information concerning the life and work of the eminent English chemist. At the International Congress of Applied Chemistry in London in 1909, Roscoe was honorary president and Sir William Ramsay acting president. The outbreak of the war produced in these two preeminent British chemists, both of whom have since died, a striking difference of attitude toward Germany and German contributions to science.

Ramsay contributed many articles to *Nature*, in which his hostile attitude toward everything German was apparent. "The Teutonic ideal is the compulsion of the individual by an omnipresent oligarchy." As regards the individual Germans: "They are disliked as business men; their methods are not regarded as fair, or their word as trustworthy. Even in the world of science this spirit is by no means unknown. In spite of their boasted progress in what they imagine to be civilization, they have been relapsing into barbarism." The remedy, suggested by Ramsay, is that "The nation . . . must be 'bled white.'" Would the progress of science be thereby retarded? He thinks not. "The greatest advances in scientific thought have not been made by members of the German race. The restriction of the Teutons will relieve the world from a deluge of mediocrity. Much of their previous reputation has been due to Hebrews resident among them."

As Thorpe points out in his biography the attitude of Roscoe was very different. As a student of

Bunsen at Heidelberg and afterwards he contracted friendships with Magnus, Rose, Helmholtz, Kopp, Kuchhoff, Quincke and other eminent men of science. In later years he viewed with deepest concern the growth of strained relations between England and Germany. His most recent publications were attempts to lessen the breach. "It would be an outrage to civilization," he wrote, "if two countries so closely allied in blood and intellectual development should come to blows." His last days, it is said, were filled with regret that international science should be trampled down by these nations in conflict.

Returning to Thorpe's account of Roscoe's scientific work, the opinion is expressed that his name will be longest remembered as that of the man who first established a provincial school of chemistry in England. Previously the departments of chemistry had been a subordinate division of the schools of medicine, at which even such eminent scientific men as Graham, Williamson and Frankland had failed to attract great numbers of students. Under Roscoe, the chemical laboratory of the University of Manchester became famous throughout the world, and at times students from nearly all civilized lands were to be found there.

Although Roscoe devoted much of his time to his class-room, to the development of his laboratory as an institution and to other educational matters, he was a diligent and successful investigator of chemical problems. Some sixty titles dealing with research appear under his name. His most important contributions were on photochemistry, reflecting his experiences with Bunsen, and his work on vanadium.



SIR HENRY ROSCOE.

Studies of importance were also made on the constitution of aqueous solutions of acids and on perchloric acid and its compounds. Roscoe did notable service to science by making more available for general use the work of Bunsen and Kirchhoff on spectroscopy, and by the publication of texts and manuals of chemistry in form suitable for students and laymen. Roscoe's career in research practically came to an end with his election to Parliament in 1886, although to his death he was a scientific and educational leader.

Thorpe describes Roscoe as a man of uniformly charming personality, always happy, serene of mind and most affectionately regarded by students and friends. A man of great energy himself, he was a skillful teacher, with a rare capacity to get the best out of his students. As a speaker he was simple and direct.

Roscoe came from a family of legal, literary and artistic merit. His father, a judge in Liverpool, wrote a "Digest" which was, for many years, a standard treatise. His grandfather, a member of Parliament, made a definite contribution to literature by his "Lives of Lorenzo de Medici and Léo X." He also made studies on botanical subjects. On Roscoe's mother's side were forbears of literary and artistic ability.

FOOD EXHIBITION AT THE AMERICAN MUSEUM OF NATURAL HISTORY

A FOOD value and economy exhibition has recently been opened at the American Museum of Natural History in New York City. Specimen meals adapted to all classes of the community, including many varieties of foods of high dietetic value that have hitherto been little used in this country, have been displayed. Among the new features are wild rice, both in its raw and cooked state; several new varieties

of war bread; stale bread re-baked by a novel process, and an exhibit of Chinese foods.

Unutilized sea foods were shown in variety. A fillet of shark meat, by virtue of its glistening whiteness and delicate texture, invited more general use. The periwinkle and sea mussel were shown in several preparations, and seaweeds were presented in the form of salads or vegetable dishes.

Many wild or primitive foods were exhibited in attractive guises. The acorn, for example, for many years a favorite food of the Indians of California, was shown in the various stages of preparation. The Indians are accustomed to beat and stir the acorn meal in a large vessel of water, permitting the acrid tannin to dissolve, after which the fluid is poured off, the meal dried and reground. The resulting acorn flour may be converted into a palatable and nutritious food. Totopotzl, a more primitive relative of the modern flaked breakfast food, was revealed in eight different shades, the colors being determined by the character of the brightly hued corn from which it was made. Explorers in Mexico and South America who have long been acquainted with this food declare the recipe to be well worth consideration. An instructive exhibit was the section devoted to corn (maize) and corn products. The present scarcity of wheat and other grains has brought corn into deserved prominence. Chemical analysis, as well as common experience, has shown Indian corn to be a very nutritious food, being rich in fats and nitrogenous matter and excelling all other cereals in albuminoids. Mixed with rye or whole wheat flour, corn may be made into excellent although coarse bread, varieties of which are extensively used on the European front. As a breakfast cereal, corn meal is, of

course, well known. By depriving corn of its gluten, starch and corn starch are secured. Maize contains more culinary oil than any other cereal, ranging from 3.5 to 9.5 per cent. in the commercial grain. By distilling and by other processes, this oil is extracted for commercial purposes. Sugar, in considerable quantity, is also to be found in corn, both in the grain and in the stalks, especially of the "fodder corn," or corn sown so closely that the ears remain undeveloped. The stalks as a consequence are richer in sugar which is extracted and appears on the market in the form of sugar, syrup, and glucose. A number of other by-products of corn have commercial value, among those displayed by the museum being a substitute for rubber.

The nutritive values of other familiar foods as sold in bulk by the grocer or as served in course by the popular-priced restaurant were graphically displayed. Many varieties of dried and canned fruits, vegetables, meats and grains and such dishes as ham and eggs, corn beef and cabbage, etc., were included. Among the articles receiving special commendation were the dried prune, and pie, which is rich in nutritive value. A variety of pastry known as "Napoleon," received the highest rating of any food displayed. Other exhibits pointed to the saving to be obtained by purchasing food in bulk rather than in packages and to other economical practices.

The Public Information Committee of the museum announces that the exhibit will be open to the public for several weeks. Members of the Museum's Department of Public Health are present daily to furnish information in addition to that obtainable from the exhibits or from the comprehensive handbook.

SCIENTIFIC ITEMS

WE record with regret the death of Sir Alexander R. Binnie, the English engineer; of two French pathologists, Dr. Felix Le Dantec, professor of tropical pathology, and Dr. Louis Landouzy, known for his work on tuberculosis; of M. Joseph Riban, the French Chemist; of Dr. H. F. E. Jungersen, professor of zoology at Copenhagen, and of Dr. Juan D. Ambrosetti, director of the Ethnographic Museum at Buenos Aires.

MISS RUTH HOLDEN, recently Alice Freeman Palmer fellow in botany at Wellesley College, has died in Moscow, Russia, from typhoid fever, contracted during her work as a member of the Red Cross relief work for Polish refugees.

A STATUE of Berthelot, the great chemist, has been unveiled in the gardens of the Collège de France. He did much of his work in the laboratories of the college.

DR. ARTHUR DEAN BEVAN, of Chicago, was elected president of the American Medical Association at the meeting held in New York City in June.

DR. E. W. MORLEY has been awarded the Willard Gibbs medal by the Chicago Section of the American Chemical Society.—In honor of Dr. J. J. Stevenson, emeritus professor of geology in New York University, the faculty club house will be known as Stevenson Hall.

AN Anglo-French Scientific Commission which includes Professor Ernest Rutherford, of the University of Manchester, and Professor Henri Abraham, of the University of Paris, is at present in this country to cooperate with American men of science in the development and use of radio-telegraphy.